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MAXIMUM PC

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Gordon
Mah Ung

THE FUTURE OF GAMING IS ON THE PC

I CAN PROVE that PC gaming (and the PC, by extension) is alive and well and doing gangbusters by just performing this test: Take any elementary- or middle-school kid and put a tablet, phone, new game console, and gaming PC in front of them, and let them choose which they want to play on. I can almost guarantee you the PC is going to come out on top.

I know because I've done that experiment at home with my own kids and, yes, the tablet or console may be used on occasion, but I'd say about 80 percent of the gaming is done on the PC. In fact, last summer (and probably this one, too), I hosted a small nine-person LAN party for my son. I broke out a few old towers, borrowed the Alienware X51 micro-tower I had in for review and, of course, there was pizza for lunch. Most of the kids brought laptops that ranged from AMD-based to Intel-integrated graphics. Not high-end rigs, but then again, kids will play at low frame rates with graphics quality turned down to the lowest setting if it lets them play a PC game. There was even a Mac Book Pro (which I think we can all agree falls into the PC category more than console or tablet) at the event.

The game of preference among these mostly 8- and 9-year-olds? Minecraft. The brick-building phenomenon that just won't quit. This indie game lets you build or battle, and its ability to be modified has seen servers set up to emulate Battlefield, Call of Duty, and DayZ, among others—just with the faux 8-bit blocky graphics. There are versions of Minecraft on iOS, Android, and consoles, but the king is on the PC, where the game has just surpassed 14 million copies sold. What's so significant about that figure is that it's 14 million people—many of them kids—who are now died-in-the-wool keyboard/mouse users.

One of the biggest barriers to entry for PC gaming for console users has been getting used to WASD for gaming. I had a good friend in the 1990s who took years to finally get used to the keyboard and mouse. Once he crossed that line, he never looked back, and eventually junked the pile of funky controllers he had accumulated.

These 14 million gamers who play Minecraft are now fully trained on mouse and keyboard, and they know what's superior. Minecraft isn't the only hot game the kids play, of course, but one thing I know is they all want to game on the PC. They will certainly go on to other forms of gaming in their lives, but I am confident that the majority will never turn their backs on PC gaming because they know it's the superior platform.

Gordon Mah Ung is Maximum PC's deputy editor, senior hardware expert, and all-around muckraker.

↘ submit your questions to: comments@maximumpc.com

THE NEWS

Asetek Sues to Protect Liquid-Cooling Patents

Files suits against Cooler Master and CoolIT for control of the US liquid-cooling market

THE BURGEONING closed-loop CPU-cooler market may be headed for a drastic reduction in size this year, as Asetek looks to steamroll competitors with its patent-infringement lawsuits.

Last summer, Asetek's threat of litigation led Swiftech to voluntarily withdraw a product, and if successful with its similar suits against Cooler Master and CoolIt, Asetek could have the run of the popular closed-loop cooler (CLC) kits in the US market.

CLC kits integrate a radiator, pump, tubing, and water block into easy-to-install units that requires no maintenance, are more effective than air coolers, and easier to install and maintain than custom coolers.

For those who aren't familiar with Asetek, the Danish cooling company sells designs that other companies rebrand or tweak slightly and sell under their own name. Some of its more popular models are currently sold as the Corsair Hydro H55, H75, H90, H105, and H110. It also manufacturers the NZXT Kraken X40, X60, and the Thermaltake Water 3.0 kits, as well.

The patents in question—8,240,362 and 8,245,764—are both titled "Cooling system for a computer" and date back to 2005. The patent filings include passages that some criticize as being overly broad, such as: "The cooling system has a heat exchange interface for providing thermal contact between the processing unit and the cooling liquid for dissipating heat from the processing unit to the cooling liquid." Nonetheless, the US patent office granted both patents to Asetek in 2012, and the company began enforcing them shortly thereafter. Just six months after releasing its H220 cooler, Swiftech stopped selling the unit to avoid litigation, although it maintained the design didn't infringe on Astek's patents.

In Cooler Master's case, the allegedly infringing products are its Seidon 120M and 240M kits. Asetek wants these taken off the market, and it wants Cooler Master to pay damages as well as court fees if the case goes to trial. As for CoolIT, its CEO Geoff Lyon told *Maximum PC* that Asetek is claiming infringement on several of its products, such as its ECO coolers, which are currently in the market as the Corsair H60, H80i, and the H100i.

Cooler Master, however, has decided to fight. It released a statement asserting that "[Asetek's] main purpose is to block its competitors to enter the market and gain the prime-time profits." CoolIT officials said they are also counter-suing Asetek for allegedly violating a patent CoolIT holds on liquid cooling, and also asking the US Patent and Trademark Office to nullify Asetek's original patents on grounds that they previously existed as "prior art."

Both CoolIT and Asetek are due in court later this year, if mediation fails. Asetek declined to comment on any of the ongoing litigation, but did tell *Maximum PC* that it wasn't in the business of licensing out its patents or "selling licenses," and intended to protect its intellectual property. In other words, if CoolIT and Cooler Master lose the suits, both are likely to have to cease selling the designs at issue.

These types of suits over apparently "obvious" ideas aren't new in technology, of course. In 2008, Ultra Products sued power-supply vendors over modular-cables patents it held. Ultra Products did allow competing designs to be sold for a fee, but Antec was able to have the US Patent and Trademark office overturn the patents based on prior art, as Hewlett Packard had filed for a patent for modular cables in 2000. **–Josh Norem**

COOLER MASTER

Cooler Master's Seidon 120M is just one of several closed-loop liquid cooling kits under fire by Asetek for alleged patent infringement.

AMD Releases Mantle API

After months of waiting, CPU- and GPU-maker AMD finally released driver support for its highly touted Mantle API, which it positions as a replacement for DirectX on Graphics Core Next–enabled parts.

At the same time, Electronic Arts updated Battlefield 4 to support AMD's Mantle-enabled drivers, which had been planned for several months. The game is also bundled with several GCN products, including AMD's A10-7850K CPU as well as some video cards. Early benchmarks around the Internet indicated frame rate improvements of up to 20 percent, with the high-end getting the largest increase. And since the technology is still brand-new, there's plenty of time for future game patches and driver refinements. **–BV**

NSA Spies on Offline PCs

According to the *New York Times*, the NSA has been using radio waves to spy on offline PCs since at least 2008. It's not as easy as flipping a switch, though. A secret transmitter has to be physically installed in the target PC, but the paper reports that this can be done at the factory, rather than by a secret agent man breaking into your underground lair. The NSA has allegedly been hard at work on this, putting the transmitters into nearly 100,000 computers around the world. The *Times* says they've targeted the Chinese Army, Russian military, and Mexican drug cartels and law enforcement. **–PL**

HP Resurrects Windows 7

Citing popular demand, Hewlett-Packard said it will start selling new computers with Windows 7 rather than Windows 8.1. The PC giant isn't hiding it, either. The new push was displayed prominently on the "desktops & all-in-ones" section of its web site. This does not appear to be a batch of old computers that HP wants to unload, either, since all of the PCs use Intel's 4th-generation Haswell CPU. The overwhelming majority of HP's systems still come with Windows 8.1, and these Windows 7 systems could be upgraded to the newer OS during checkout for an additional $100. **–PL**

Tom
Halfhill
Fast
Forward

THE NEXT GUTENBERG PROJECT

CONFESSION: I've copied copyrighted music. It's not my first time, and it won't be my last. Yet I think my action is legally defensible, and I'd like to see thousands of people doing the same thing in a globally organized fashion.

Now, as a writer, I respect copyrights. But I'm also a music lover. The music I copied wasn't a current release downloaded from a renegade peer-to-peer network. It was a vinyl LP released in 1972 that was never reissued on CD or in any other digital format I could find.

The LP belongs to a friend who no longer owns a turntable. She asked me to make her a CD. Actually, it would be easier for me to buy her an official copy, except no CD or MP3 was ever released. So, using a digital recorder, I copied the album, imported the WAV files into an audio editor, filtered out the pops, and burned a CD-R. It's not theft, because my friend still owns the LP. It's not her fault the record company hasn't reissued it.

I'd like to see a global project to make digital copies of other out-of-print records (and videos). The copies should be free to people who already own the analog material and made available at low cost to others. We need a legal mechanism for compensating volunteers who make the copies and for funneling profits to the copyright owners. Those owners should be pleased, because they haven't been making money from the stuff anyway. Usually, a reissue isn't worth their trouble.

This process would resemble the Gutenberg Project, except it wouldn't be limited to public-domain books. It would offer new life to copyrighted music and video that isn't popular enough to justify commercial reissue, but still has an appreciative audience. Are you listening, RIAA?

Tom Halfhill was formerly a senior editor for *Byte* magazine and is now an analyst for *Microprocessor Report.*

Thomas McDonald
Game Theory

THE WORKER DESERVES HIS WAGE

IS A NEW ECONOMIC model about to break through and dominate gaming, replacing the old single-price and subscription models? Some people seem to think so, with all micro-transactions, all the time, taking the place of the $60 box of air or Steam download.

Shareware upset the retail model in the early 1990s and proceeded to drive a huge PC gaming boom. It remains to be seen if F2P can do something similar, but games like Path of Exile and Hearthstone are showing how F2P can work big.

As F2P crosses into the mainstream, there are, of course, some caveats. First, balance and design are issues. Many F2P titles have been PTW (pay to win) titles, and that's just bad design. Path of Exile addressed this with what they called "ethical micro-transactions": none of what you buy affects the game, but simply provides cosmetic extras.

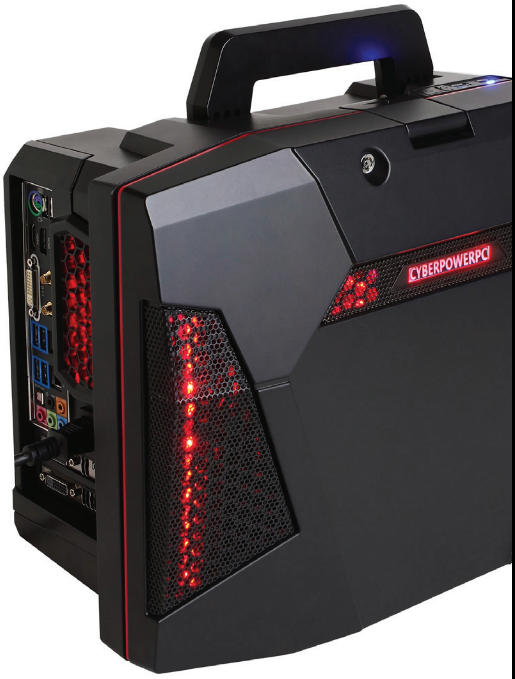
Second, mainstream publishers are going to milk this to death by holding back major content and then charging for it later. EA is already planning to slather a thick gooey coating of micro-transactions over everything they do, and we can count on them to do it with good taste and restraint, am I right?

Third, F2P games are supporting a vast legion of deadbeats on the backs of a minority of paying customers, and here's where the title of this column comes in. If you're playing a game any length of time, it isn't free any more. You owe the developers money even if you don't want painted horse armor or whatever. I put a lot of hours into Pocket Trains lately, and kicked in a few bucks even though I didn't need to, because the people who made it deserved to get paid.

If you're spending a lot of time leeching from F2P games without paying, you should cut that out and put a little something in the kitty. The future of good PC gaming may depend upon it.

Thomas L. McDonald is Editor-at-Large of *Games Magazine*.

CyberPowerPC's Briefcase System



Boutique system builder CyberPowerPC recently unveiled the Fang Battle Box, the outer shell of which is shaped like a briefcase and designed for easy transport. Its dimensions are somewhere between a micro-tower and the small form factor "shoebox" shape, and it comes with all off-the-shelf parts. The system demoed for us included an Intel Core i7-4770K with a closed-loop liquid cooler, an Nvidia GeForce GTX 780 Ti, 16GB of RAM, and a 120GB SSD. CyberPower PCs says it plans to have the systems on sale by the time this issue hits the stands. **–TM**

Toshiba Trims OCZ Warranties

In the wake of purchasing hardware-maker OCZ's SSD division, electronics giant Toshiba announced that it was terminating the warranties on a number of older and lower-tier OCZ SSDs (most of which have been discontinued, anyway). Notable exceptions to this termination include the Vertex 1 through 4, and most of the fancy RevoDrive series, which uses the PCI Express to get higher theoretical transfer speeds than are possible with traditional SATA. The mid-tier Agility SSDs will have support until January 22nd, 2015. Toshiba apparently did not purchase OCZ's power-supply division, but an OCZ representative told us that this group was being sold to a third party, with the lucky winner as yet unknown as this issue goes to press. **–TM**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

FACEBOOK
The privacy-challenged company turns 10 and is most likely here to stay. Our FB fans certainly love it.

MICROSOFT
The company finally has a new CEO, so hasta la vista, Steve Ballmer, and hello, Satya Nadell from the company's cloud division.

AMD
After four months of teasing, it finally released its Mantle API. Now, if we could just find an R9 290X card in stock to use it.

TRAGEDIES

AT&T
Filed for a patent that would restrict bandwidth according to the type of file you are downloading. Booooo.

INTEL
Sadly, it closed its AppUp store for Windows PC this month. Yes, Intel had an app store.

SKYDRIVE
This month, Microsoft was forced to abandon the SkyDrive moniker due to trademark. OneDrive just doesn't sound as cool.

Quinn
Norton
**Byte
Rights**

THE GRIMM INTERNET

THE INTERNET HAS always been something of a mysterious forest, full of dancing hamsters, lolcats, Mario mushrooms, and of course, trolls. But over the last year, we have also learned that the Internet is a dangerous place.

We've learned the net's infrastructure itself is hostile, and that governments anywhere, including our own, can and do attack us at nearly any point. Systems such as the NSA's Quantum can monitor or change what we say or see, and even remotely take control of our computers. Prism taught us that our data was not safe in the castles of the cloud, and Xkeyscore showed us how the NSA could build a total picture of anyone—including activists that we later found members of Five Eyes (the spying cooperative) were targeting domestically. Not enough has been said of what makes all these terrible powers possible. It's not anything reserved to America or Britain. These programs exploit the architecture of the net, something any large actor—be it a government or corporation—could do, as well. And so, many probably are. The Internet, like something out of a Grimm's fairy tale, is a magical and evil place.

Upon learning this, many people have responded with despair. They say the Internet is broken, dying, a tool for authoritarians. But like all the old myths and fairy tales, there's a good magic, too, one thing that stops *all* these attacks in their tracks: encrypting our network data.

"Encryption works," said Edward Snowden, in a situation where he couldn't have said much of anything if it didn't. Encryption, particularly what's called end-to-end encryption, is the only chance for safety and freedom from the network powerful. It disguises and protects your data using powerful math. It's time for all netizens to learn about and use encryption, and demand it from their vendors. It's time for a talisman to get us through the Internet's dark night.

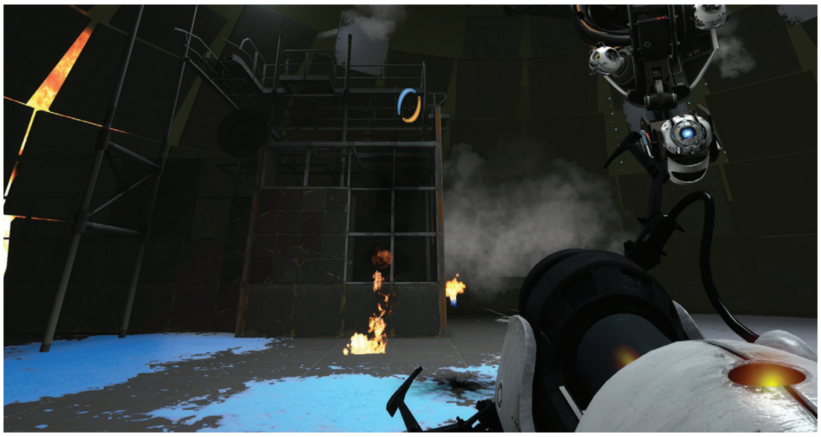
Quinn Norton writes about copyright for Wired News and other publications.

Valve Begins In-Home Streaming

Valve Software, developer of the Steam online game store and games such as Portal and Left 4 Dead, began giving out closed-beta invites to its "in-home" game streaming in late January. This technology allows you to stream a game from a Windows PC across your local network to another PC that's running the Steam client. (You can stream from Linux or Mac OS, but Valve says support there is a work in progress). That means that gamers using just Linux or Mac OS on the target PC can play any game in the Steam library, even if it's listed as being incompatible with Windows. The game also does not have to be updated for this service to work; the Steam client takes care of handling compatibility. The streaming host is doing all the graphics and sound processing, too, so the target system doesn't have to be gaming-grade. So, for the receiving end, you won't have to buy one of those newfangled "Steam Machines," but they should be good as hosts.

The target PC doesn't have to be high-end but the connection should be fast. Reports from early users suggest a wired Gigabit ethernet connection is preferable.

The technology is basically like streaming service OnLive, but since it's designed to work over a local area network, there's no monthly fee. You can even be disconnected from the Internet and still use Valve's streaming, as long as the gameplay itself does not require an Internet connection. OnLive is also limited to 720p resolution, due to Internet bandwidth constraints. Steam's implementation allows 1080p at 60 frames per second, as long as your local network is fast enough. **–TM**



Hitachi HDD Most Reliable?

Cloud backup company BackBlaze has published a hard-drive reliability survey that may surprise you. Leading the pack was Hitachi, with an annual failure rate of no more than 1.5 percent from a sample size of nearly 13,000 drives in BackBlaze's data center. The company said after three years, 96.9 percent of drives were still running. BackBlaze said it had roughly as many Seagate drives, whose three-year success rate was a more modest 73.5 percent. Western Digital trailed behind the winner, but the sample size was fewer than 3,000 hard drives. The hard-drive survey isn't without controversy though, as some IT sites have criticized it for not being scientific. **–TM**

Sony Sells VAIO Division

Sony announced that it was in the process of selling its ailing VAIO PC division to Japan Industrial Partners Inc., a Japanese investment firm. According to reports, Sony would obtain a 5 percent stake in a holding company created to manage the new business. Sony did not mention how much money it sold the division for, but UK newspaper the Telegraph reported a price tag of $490 million. As a part of its restructuring efforts, Sony also said it would be cutting 5,000 jobs by next March and selling its TV division as well, which has lost several billion dollars over the past nine years. **–TM**

THE LIST

8 HORRIFIC GAME LAUNCHES

8

SPORE

The most pirated game of 2008; fans ripped EA for implementing DRM rootkit software.

7

TOTAL WAR: ROME II

When your game won't even boot, you begin to appreciate beta testing a little more.

6

SIM CITY

EA's Internet-connection requirement led to massive outages and a seriously pissed-off fan base.

5

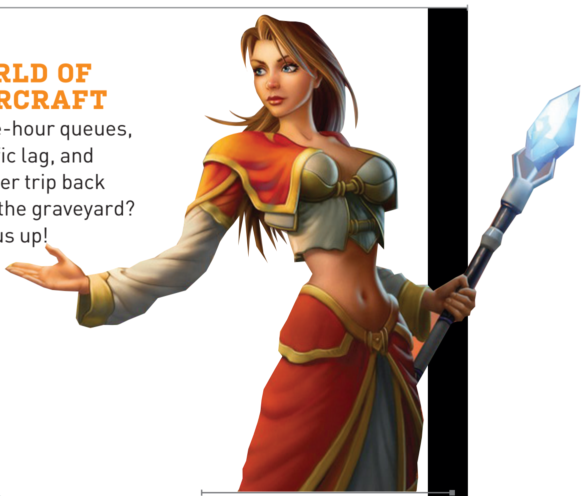
THE WAR Z

Allegations of false advertising, buggy gameplay, and a name change pretty much say it all about The War Z.

4

WORLD OF WARCRAFT

Three-hour queues, horrific lag, and another trip back from the graveyard? Sign us up!



3

BATTLEFIELD 4

We don't even know where to begin with BF4, it's been that bad.

2

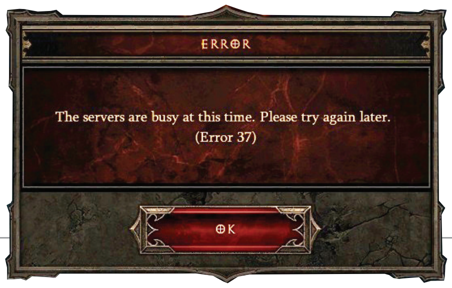
HALF LIFE 2

The first game to require Steam activation, HL2 is a reminder that Steam wasn't always king.

1

DIABLO 3

D3's launch was cursed by the Lord of Terror himself with the infamous Error 37.



ERROR

The servers are busy at this time. Please try again later.
(Error 37)

HEAD TO

BY JOSH NOREM

Seagate 1TB Hybrid vs. WD Black2 Dual Drive

Every mobile user who is limited to just one storage bay wants the best of both worlds: SSD speeds with HDD capacities. Both Seagate and WD have a one-drive solution to this problem, with Seagate offering a hybrid 1TB hard drive with an SSD cache for SSD-esque performance, and WD offering a no-compromise 2.5-inch drive with both an SSD and an HDD. These drives are arch rivals, so it's time to settle the score.

WD's Black2 Dual Drive is two individual drives in one enclosure, and it has the price tag to prove it.

ROUND 1

Specs and Package

The WD Black2 Dual Drive is two separate drives, with a 120GB SSD riding shotgun alongside a two-platter 1TB 5,400rpm hard drive. Both drives share a single SATA 6Gb/s interface and split the bandwidth of the channel between them, with the SSD rated to deliver 350MB/s read speeds and 140MB/s write speeds. The drive comes with a SATA-to-USB adapter and includes a five-year warranty. The Seagate SSHD uses a simpler design and features a 1TB 5,400rpm hard drive with an 8GB sliver of NAND flash attached to it, along with software that helps move frequently accessed data from the platters to the NAND memory for faster retrieval. It includes a three-year warranty and is otherwise a somewhat typical drive aimed at the consumer market, not hardcore speed freaks. Both drives include free cloning software, but since the WD includes two physical drives, a USB adapter, and a longer warranty, it gets the nod.

Winner:
WD Black2

ROUND 2

Durability

This category is somewhat of a toss-up, as the WD Black2's overall reliability is degraded somewhat by the fact that it has a spinning volume attached to it, giving it the same robustness of the Seagate SSHD. There's also the issue of the WD Black using the slightly antiquated JMicron controller. We don't have any reliability data on that controller in particular, but we are always more concerned about the SSD controller you-know-whating the bed than the memory, which is rated to last for decades, even under heavy write scenarios. Both drives also use two-platter designs, so neither one is more or less prone to damage than the other. In the end, we'll have to go with the Seagate SSHD as being more durable, simply because you only have to worry about one drive working instead of two.

Winner:
Seagate SSHD

HEAD

Seagate
Laptop SSHD
seagate.com
1TB

Seagate's hybrid drive offers HDD simplicity and capacity, along with SSD-like speed for frequently requested data.

ROUND 3

Performance

Seagate is very clear about the performance of its hybrid drives, stating that they "boot and perform like an SSD," but it never says they're faster. It also claims the drive is "up to five times faster than a hard drive," which seems like a bit of a stretch. It's difficult to actually benchmark a caching drive because it won't show on standard sequential read tests, and it gets killed by SSDs in access time tests. That said, we did see boot and PCMark Vantage scores improve significantly over time. Our boot time dropped by more than half, going from 2:27 to 1:07 after several boots, and our PCMark Vantage score shot up from 6,000 to 19,000. Still, these times are much slower than what we got with the WD SSD, which booted in 45 seconds (the system had three dozen programs installed), and hit 33,000 in PCMark Vantage.

Winner:
WD Black2

ROUND 4

Cloning Package

Both drives include free software to help you clone your old drive and, in an odd twist, both companies use Acronis software to get 'er done. Seagate's software is called DiscWizard, and works on OSes as old as Windows 98 and Mac OS 10.x. WD throws in a copy of Acronis True Image, though it only works with WD drives attached via the included USB-to-SATA adapter. We tested both software packages and found them to be nearly identical, as both let us clone our existing drive and boot from it after one pass, which can be tricky at times. Therefore, we call the software package a tie since they both perform well and use Acronis. However, WD's $300 bundle includes a USB-to-SATA adapter that makes the cloning process totally painless. Seagate makes you forage for a cable on your own, which tips the scales in WD's favor.

Winner:
WD Black2

ROUND 5

Ease of Use

This round has a crystal-clear winner, and that's the Seagate SSHD. That's because the Seagate drive is dead-simple to use and behaves exactly like a hard drive at all times. You can plug it into any PC, Mac, or Linux machine and it is recognized with no hassle. The WD drive, on the other hand, only works on Windows PCs because it requires special software to "unlock" the 1TB hard drive partition. For us, that's obviously not a problem, but we know it's enraged some Linux aficionados. Also, the WD drive only has a 120GB SSD. So, if you are moving to it from an HDD, you will likely have to reinstall your OS and programs, then move all your data to the HDD portion of the drive. The Seagate drive is big enough that you would just need to clone your old drive to it.

Winner:
Seagate SSHD

And the Winner Is...

This verdict is actually quite simple. If you're a mainstream user, the Seagate SSHD is clearly the superior option, as it is fast enough, has more than enough capacity for most notebook tasks, and costs about one-third of the WD Black2. But this is *Maximum PC*, so we don't mind paying more for a superior product, and that's the **WD Black2 Dual Drive**. It delivers both speed and capacity and is a better high-performance package, plain and simple.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Surface Pro 2
> Blu-ray Blues
> Win 7 Downgrade

High-res gaming: SLI or no?

I have a computer with a Core i7, Nvidia GeForce GTX 760 GPU, and 8GB of RAM. I currently use a 28-inch 1920x1200 monitor. Can I upgrade to a 30-inch 2560x1600 monitor and maintain good frame rates in first-person shooters such as Battlefield 4? If not, would two GTX 760s in SLI solve this problem, or am I better off just getting a GeForce GTX 770 or 780? I would need a new motherboard in order to do SLI.

—Michael J Posner

THE DOCTOR RESPONDS: It depends what you mean by good. You can get technically playable frame rates on high quality at 2560x1600 with one GTX 760, if you consider 30fps to be playable. The Doc generally recommends the fastest single-GPU setup you can afford. In this case, that would be selling your 760 and buying a GeForce GTX 780. Adding another 760 will increase your heat, noise, and power consumption, and you'll be waiting for SLI profiles for newer games—not to mention the cost of upgrading your motherboard. It just makes more sense to run a single faster card. For what it's worth, a single GeForce GTX 780 will give you about 25 to 40 fps at 2560x1600 on Ultra with 4xAA. Turning down AA and stepping back a few visual quality settings should easily give you a solid 60 fps.

Is the Surface Pro 2 Enough?

My current system is one I built using an MSI K9A2 Platinum mobo, AMD Phenom II X4 965 CPU, and 4GB of RAM. I use this system mainly for email, web surfing, Word, and Excel, but occasionally I do some work with Adobe Lightroom.

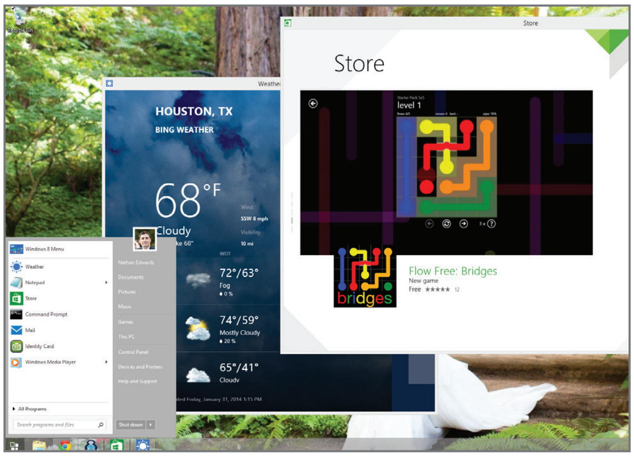
I would like to get a tablet that I could use as a laptop, tablet, and my desktop. I have been looking at the Microsoft Surface Pro 2 with 8GB RAM and a 256GB SSD. My question: Will this be enough horsepower for what I do? My current system is running at 3.32 GHz and has four cores, but only four threads. The Surface Pro 2, with the newer CPU, goes from 1.9–2.9GHz but has two cores and four threads.

—Alan Feinstein

THE DOCTOR RESPONDS: If your current system is working fine for what you do, then yeah, the Surface Pro 2 will be great. It will even be faster in most things—the Pro 2's Haswell Core i5-4300u should be much faster in single-core performance than the Phenom in your rig. Combined with additional RAM, SSD, far less power draw, and the portability factor, the Surface should be a pretty good bet for you.

There are a couple of caveats, though: Lightroom can be unpredictable in performance, and there is a chance that certain chores will be faster on the Phenom, but the Doc bets the SSD, RAM, and Haswell part will likely be the better Lightroom experience. Even video encoding, if you ever do that, should be faster on the Haswell part over a Phenom.

The second caveat is that the Surface Pro 2 is good, but not great. You may find the Modern app selection limited, the kickstand only has two angles (though that's better than the single angle the first Surface Pro had), and neither of the keyboard covers has a particularly good trackpad. Still, it's as good a convergence device as the Doc has seen yet.



The old ways were better! Start8 brings back the Start menu, and ModernMix lets you run Modern UI apps on your desktop.

Downgrade from Windows 8 to 7

I recently purchased a new laptop and, of course, it came with Windows 8. I would like to change it to Windows 7. My old laptop was Vista, which I upgraded to Windows 7 Home Premium, then to Professional. I will load a version of Linux on the old laptop. This will leave a Windows 7 license unused. Is there a way to go from Win

↘ submit your questions to: doctor@maximumpc.com

8 to Win 7, or will I have to buy a license for Win 7 and erase the drive on the new laptop and install the new Win 7?

—Patrick Flynn

THE DOCTOR RESPONDS: Your old Windows 7 license, since it sounds like it was an upgrade of an OEM Vista license, is likely tied to the specific computer you first bought it for. However, some Windows 8 and 8.1 computers come with "downgrade rights," which basically let you install Windows 7 over Windows 8 without wiping the whole hard drive. The Doc can't say for sure whether you have downgrade rights, since we don't know your laptop's make and model, or even which version of Windows 8 you have—Windows 8 and 8.1 Professional are generally the versions with downgrade rights, and will let you downgrade to Windows 7 Pro. You'll need a Win 7 Pro install disc and your Win 7 product key to try that route.

If your computer doesn't have downgrade rights, you'll need to track down an install disc and install Win 7 from scratch. If your Win 7 disc was a full retail version and not an upgrade, you should be able to install it. It may fail the automatic activation, so you'll have to do it by phone and explain to them that you are moving the license to a newer machine.

Windows 8 does bring a lot of improvements to the desktop environment, though, so depending on what you don't like about Windows 8, there are ways to make it more like Windows 7 without downgrading. If the Modern UI interface is what you don't like about Windows 8, you can use a program like Start8 ($5, http://bit.ly/MPC_start8) to disable the Modern UI Start screen and bring back the Start Menu, and you can use ModernMix ($5, http://bit.ly/MPC_modmix) to run Modern UI apps as windows on your desktop rather than full-screen. It's cheaper and easier than downgrading to Windows 7 if you find that you will need to buy a new license.

MP3 Blus

I burned a data Blu-ray disc with MP3 music and my Sony Blu-ray player will not play the MP3s. It will not even show the songs. Is this a known issue? Thanks.

—Terry Hollingsworth

THE DOCTOR RESPONDS: It's not clear that entertainment center Blu-ray players can even read data Blu-ray discs, and we're not able to find any indication that Sony's players can read MP3s. However, many Sony Blu-ray players do have DLNA support, so you can always try streaming your MP3s over your home network using something like Plex. You'll have to dig into the manual of your player to see if it supports DVD+R or CD data discs.

Android on Clovertrail?

Hello Doctor, I have an Asus VivoTab Smart ME400C tablet with Windows 8.1. I would like to dual-boot Android and Windows 8.1 like the new Asus Transformer Book Duet tablet. Can you tell me if it is possible, and if so, how would I get the Android OS? I have had luck in the past booting XP and Windows 7 with many different USB devices. This only has a Micro SD card slot for added storage that I can try to boot from. Please help.

—Kim Wofford

THE DOCTOR RESPONDS: It probably can't be done, at least not yet. Intel initially said it would not support Linux-based operating systems on the Clover Trail platform (the Atom implementation that your VivoTab uses) and there were reports that some Windows tablets had locked boot loaders to prevent dual booting. The recently announced Asus Transformer Book Duet can dual-boot Android and Windows, but it's using a Haswell processor. However, there do now seem to be Android devices, like the Acer Iconia A1-830, that are shipping on Clover Trail platforms, so it's possible some enterprising XDA developer will port Android to your device.

However, you can use a program like Blue Stacks (http://bit.ly/MPC_appplayer) to run Android apps on your Windows tablet. It's not quite the same as dual booting, but it's something.

More RAM or an SSD?

I'm running an ASUS ROG G750JX Laptop with a Core i7-4700HQ CPU @ 2.4GHz, 16GB DDR3 RAM, and a GeForce GTX 770M. I was planning on an SSD upgrade, but was wondering if another 16GB of RAM would give me enough of a boost to make it worthwhile, or would that be overkill? I am a gamer and love to play online/multiplayer games. It's not necessarily a question of budget, but would the performance I'd get out of another 16GB of RAM be worth the upgrade? Or would it be better to just put that money toward a bigger SSD?

—Christian Cryder

THE DOCTOR RESPONDS: Definitely the SSD. 16GB of RAM is more than enough for any game you're likely to be playing. Although your laptop supports up to 32GB of RAM, there's no reason to spend the money. You're much better off with an SSD, which will help with startup and level-load times. Since you're on a laptop, aim for the highest capacity drive you can afford: A 500GB Samsung 840 EVO, for example, is around $300, while a 1TB is around $540. A 960GB Crucial M500 is even cheaper, at around $460. Either would be great for your purposes.

Problems, problems everywhere

For the last few months, I've been running out of disk space on my 120GB Samsung 840 SSD. I have been running CCleaner, moving games to my hard drive, and so forth, but my SSD seems to just keep decreasing in free space. I have an Intel Core 2 Quad Q9300 with stock cooler, an EVGA 780i motherboard, 4GB DDR2/800 OCZ RAM, an Antec 850W PSU, an XFX 9800GTX+ graphics card (now used as a dedicated PhysX card), a Gigabyte GTX 760 OC graphics card, a Sound Blaster X-Fi Xtremegamer sound card, and a 500GB Seagate HDD.

Today, my PC would not POST. No beep, no video, nothing. I went ahead and removed my 9800GTX PhysX card and made sure the PSU connections were solid. After that, the PC booted and all of a sudden my SSD showed as having 40GB free but my sound was broken. I managed to fix the sound by routing it through my monitor instead of the sound card. Could you help me figure out what is going on? This doesn't seem to have a simple explanation, though I'm really glad to have my SSD storage back.

—Tim

THE DOCTOR RESPONDS: It sounds like you have several different issues going on. The Doctor does not believe that your lack of space is related to the no-POST issue, although suddenly finding 40GB of storage after a reboot is puzzling but perhaps related to automated OS maintenance. Still, your real problem right now is your sound cutting out. It sounds like you may have jostled the sound card when removing your 9800GTX. The Doc would remove and reseat the sound card in the same PCI slot. If it doesn't show up, boot into safe mode and uninstall and reinstall the drivers for it. If it still doesn't show up, you should try moving it to the board's other PCI slot.

If that works, you still have the problem of why your system decided not to POST. The Doc has read reports of your motherboard and other 780i boards suffering issues with the BIOS chip becoming loose in its socket. If it doesn't POST again or if you receive an FF code, you may want to push on the BIOS chip (with the system powered off, of course). If you're lucky, your problem was just the power supply connector, GPU, or RAM working loose. If they were never fully seated properly, it may have taken all of this time or a simple bump to finally get them far enough out of place to prevent a POST.

4K IS HERE

ULTRA HD IS THE NEXT-GEN PC RESOLUTION—HERE'S WHY YOU HAVE TO HAVE IT

BY JOSH NOREM

ASUS
3-WAY SLI
GEFORCE GTX
GEFORCE GTX

Dream Machine 2013 had some bitchin' hardware, but most of it was available at retail for any well-heeled hardware hound. One part, though, was not available to the unwashed masses: its glorious 4K monitor. You see, 4K was an other-worldly resolution back in mid-2013, simply because it offered four times the resolution of 1080p—at a wallet-busting expense of $3,500.

As we enter 2014, though, 4K is now available and affordable, and all modern games support it, making it one hell of an upgrade. Over the next eight pages, we'll tell you all about 4K, show you what you need to run it at its maximum output, and explore 4K gaming benchmarks, too. But as sweet as it is, it's not for everyone, so read this guide before making the move.

ASUS
3-WAY SLI
GEFORCE GTX

The Asus PQ321Q is 4K for the ballers, with its IPS 60Hz panel and a price tag of $2,800.

WHAT IS 4K?

A SLIGHT MISNOMER, BUT CATCHIER THAN ULTRA HD

To put it simply, 4K doubles the standard 1920x1080 resolution both vertically and horizontally to 3840x2160, which is quadruple the pixels. We can already see you folding your arms and scanning the page for a downvote button, saying, "That's obviously not true 4K. It only sums up to 3,840 pixels." "True" 4K resolution is a term used in the movie industry. When you hear about movies being shot in 4K, they're typically shot at 4096x2160 with an aspect ratio of 17:9. On the PC side, we generally run with television makers, who have mostly settled on a resolution of 3840x2160, which uses the same 16:9 aspect ratio as 1080p. Despite this being far short of 4,000 pixels horizontally, television and monitor makers have all settled on 4K as the term to push, rather than Ultra HD. In other words, we don't make up the buzzwords, so hate the game, not the player.

In a historical context, 4K is simply the next rest stop along the path of technological progress. Way back in the day, we ran our displays at 640x480, then 800x600, then 1024x768, and then 1280x1024, and so on. As graphics cards became more powerful, we were slowly able to bump up our display resolutions to where they are now, which for a large majority of gamers is 1920x1080, or 1080p. Society has settled on 1080p as the go-to resolution right now, simply because those monitors (and TVs) are very affordable, and you don't need a $500 graphics card to run today's games at that resolution.

Not everyone is average, though. Many enthusiasts today run 27-inch or 30-inch monitors at much higher resolutions of 2560x1440 or 2560x1600, respectively. That may seem like a step up from 1920x180, but a GeForce GTX 780 ti or Radeon R9 290X isn't even stressed by 2560x1440 gaming. Factor in PCs with multiple GPUs, and you start to wonder why we've been stuck with 2560x1600 for more than seven years, as everything else has leapt forward. We won't question that wisdom, but we do know that it's time to move forward, and 4K is that next step. Looking ahead, the industry will eventually move to 8K, which quadruples the pixels, and then 12K, and so forth. In fact, some vendors already demonstrated resolutions way beyond 4K at CES 2014, including Nvidia, which ran three 4K panels at 12K using four GTX Titans in SLI. For 2014 and beyond, though, 4K is the new aspirational resolution for every hardcore PC gamer.

IT'S ALL ABOUT THE PIXELS PER INCH

You know how every time we pass around the sun once more and it's a new year, people joke about their "New Year's Resolution" being some sort of super-high monitor resolution? Well, we do it, too, because as hardware aficionados there's always room to grow and new boundaries to push. We want our hard drives to get bigger right alongside our displays, so the move into 4K is something we have been looking forward to for more than a year; as resolution scales up, so does the level of detail that is rendered on the screen. The official term for this spec is pixels per inch, or PPI, and it's a good bellwether for how much detail you can see on your display.

To see how PPI varies according to screen size, let's look at a few examples. First, a 24-inch 1920x1080 display sports roughly 91 pixels per inch. If you bump up the vertical resolution to 1,200 pixels (typical on some 16:10 ratio IPS panels), you get a PPI of 94. If you crank things up a notch to 2560x1440 at 27 inches, the PPI goes to 108, which is a small bump of about 20 percent, and probably not very noticeable. Moving on to 2560x1600 on a 30-inch panel, you actually get lower density, arriving at a PPI of 100. To put this in the context of a mobile device, the Google Nexus 5 smartphone has a 4.95-inch display that runs a resolution of 1920x1080, giving it a crazy-high PPI of 445. The iPad's 9.7-inch screen delivers a PPI of 264, and the iPhone 5's PPI is 326 pixels. Clearly, there's a lot of room for improvement on the PC, and 4K is a step in the right direction.

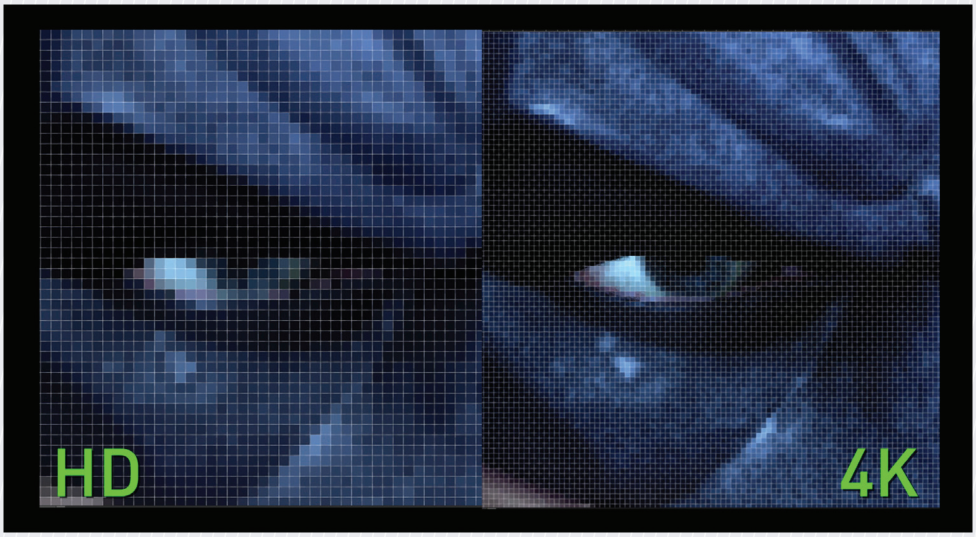


Image Credit: Nvidia

The difference between Full HD 1080p and 4K is huge, and noticeable.

PIXEL PEEPING

Now, let's look at the PPI for a few of these fancy new 4K monitors that are coming down the pike. We'll start with the model we used for Dream Machine 2013, which is an Asus PQ321Q. With its resolution of 3840x2160 spread across 31.5 luscious inches, its PPI is a decent 140, a noticeable increase from a 2560x1600 display. Not enough for you? Dell has a new 24-inch 4K monitor dubbed the UP2414Q that shrinks your icons for you while retaining their sharpness. Still, it has the highest PPI yet for the desktop panel at a skyscraping 185 pixels. Slightly below the Dell is a new Asus LCD named the PB287Q, which at 28 inches has a modest PPI of 157 pixels. Keep in mind that in some cases, this is a 50 percent increase in the number of pixels per inch, so when you tally that up across the entirety of the display, it equals quite a few more pixels, which results in a lot more detail that is visible even to the naked and semi-clothed eye.

WHY IT'S A BIG DEAL

Just like going from a 24-inch 1080p monitor to a 30-inch 1600p monitor is a life-changing experience, so is going to a 32-inch or smaller 4K panel. The level of detail you can see on the screen is surprising, and when you fire up Battlefield 4 for the first time, you'll most likely be staring at the screen with your mouth open, and not just because the server dropped you again. Gaming at 4K looks simply incredible. And unlike television, where there's a dearth of content, almost all PC games support the resolution, and some developers are even including higher resolution textures now, too.

Of course, both Nvidia and AMD are also pushing 4K because you need one hell of a GPU setup to push those pixels around. Since 4K is still extremely new and not quite ready for prime time, the hardware required to run it is in the same embryonic stage, which translates in layman's terms to "almost there but not quite." Even a GeForce GTX Titan with its 6GB frame buffer or a Radeon R9 290X and its 4GB frame buffer can barely eclipse 30fps at 4K with all settings maxed. Sure, you can turn down some of the settings and get a flagship GPU to run pretty well at 4K these days, but we'd rather castrate ourselves with a soldering iron than turn down the eye candy. We didn't spend $3,500 on a monitor, or have our friends die face-down in the muck, to turn down graphics settings, so we're not budging on that. With all settings turned up, gaming at 4K is truly cutting-edge, and is really the only application that currently stresses today's crop of high-end GPUs, aside from a multi-monitor setup. Today, getting any single GPU to run 4K at the magical 60fps is not possible. There's even a telling statement on the Nvidia website: "In order to power games at this resolution (4K) with settings turned up, NVIDIA recommends GTX 780 SLI or better."

IS 4K 'RETINA'?

First off, you have got some balls to compare a glorious 4K display to a marketing term such as "retina display." However, for the sake of argument, we'll humor you. As noted elsewhere, a 4K display can have as many as 185 pixels per inch (PPI), which is almost double what is found in today's 1080p displays. However, the term "Retina" as coined by The Jobs is usually more than 200 PPI for a notebook, and more than 300 for a mobile display. You see, a PPI rating's significance all comes down to how close you are to the display. Apple defines a Retina display as having enough pixels that the human retina can't distinguish between them, which is quite easy to pull off at a distance of 16 inches, but much less so at six inches. Therefore, mobile displays, which are held closer to your face, oftentimes have crazy-high PPI ratings. Interestingly, despite being the first to heavily push high-PPI displays, Apple has been out-Retina'd these days. The Samsung Galaxy S4 has a PPI of 441 PPI, and the Sony Vivo Xplay sits at an insane 490 PPI. The iPhone, with its rating of 326, actually isn't even in the top ten of high-PPI devices. Still, if you ask the average Joe, he'll say Retina is better. The bottom line: At a far enough distance, everything is a retina display, because pixels are indistinguishable.

GO BIG OR GO HOME

FULL HD, ULTRA HD, HD HD—WHAT DOES IT ALL MEAN?

HD 720P

A resolution with more than 700 horizontal pixels was the original "HD" resolution and was used to sell a zillion television sets the world over. On a 1600x900 20-inch display, you get a reasonable PPI of 92.

FULL HD 1080P

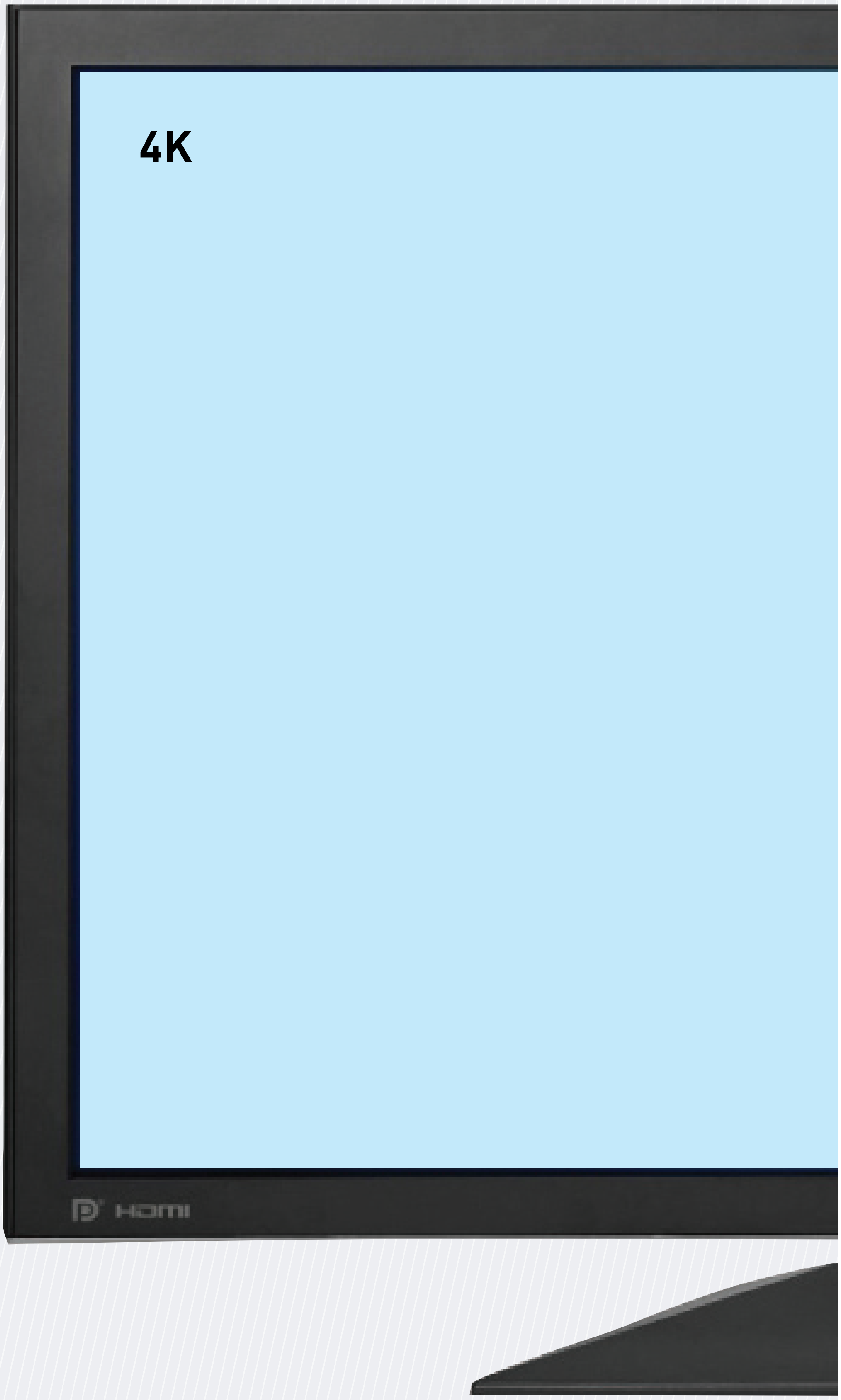
After vanilla HD came Full HD, which cranked it up a notch to 1920x1080 resolution. Full HD is just a marketing term, though, as there's no HD-sanctioning body. Full HD on a 23-inch panel delivers a PPI of 96, so, not much better than HD.

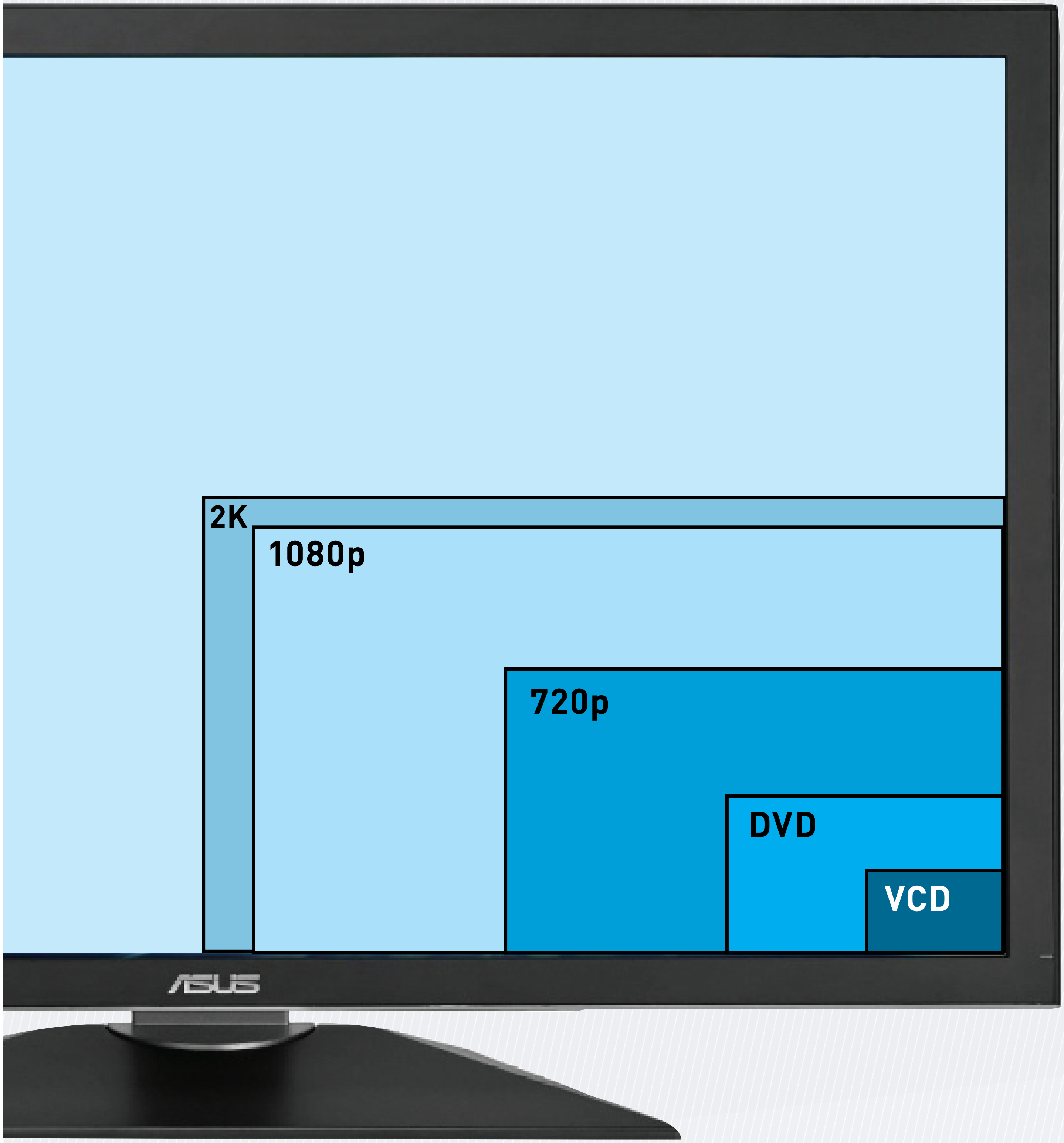
QUAD HD

Though usually not referred to by its proper name, Quad HD refers to a panel featuring 2560x1440 resolution, which is four times the pixels of HD. A 27-inch panel at this res features a so-so PPI of 108.

ULTRA HD

This is actual 4K resolution, meaning 4,000 horizontal pixels. It is four times the resolution of Full HD, and features a PPI of 144 pixels on a 32-inch panel. The term refers to how professional film is produced and projected though, so it's not really a PC term since PC displays are slightly less than 4K at 3840x2160.




2K
1080p
720p
DVD
VCD
ASUS

4K CONFUSION CLEARED UP

HOW TO PICK THE RIGHT 4K MONITOR

It used to be easy to pick a monitor when your biggest decision was choosing between an IPS or TN panel, and your choice at the high end was either 24 or 30 inches. Today, it isn't so easy. Besides the thorny question of whether to choose an IPS model for its superior color accuracy and off-axis viewing or going with a speedier TN panel, you now have to factor in very high refresh rates, pixel density, resolution differences, and even such technology as Nvidia's new G-sync. We can't pick for you, but we can help you make your decision.

As with all things in computing, there is no one-size-fits-all product. How much monitor you need depends on your specific usage. Are you a gamer? A content creator? A multi-tasker? On a budget, or a baller like Carlos Slim?

For a professional or advanced amateur editing photos or video, the color accuracy of TN panels still isn't good enough. Today's budget 4K panels, such as Dell's $699 P2815Q or Asus's $799 PB287Q, both use TN panels, so pixel peepers will want to move along. The Dell P2815Q also features a major flaw in that its refresh rate is limited to 30Hz at its native resolution. For professionals, the only real answer for now is to go big (and expensive) with the Asus 32-inch PQ321Q for $3,000, or go dense with the 24-inch Dell UP2414Q for $1,300. The Asus model uses an IPS panel from Sharp with indium gallium zinc oxide (IGZO) to help it pack the pixels so closely. The Dell is also an IPS panel, but other details of the panel technology have yet to be disclosed. Both will hit 60Hz, but you'd better have a gnarly GPU or two if you want to use these panels for gaming. The Dell's pixel density is to die for, with 183 pixels per inch. That's about double that of a standard 24-inch 1920x1080 panel. There are PC panels that are denser, but not in a desktop form factor. Remember: You'll need bionic vision, too, if you intend to use these monitors without scaling cranked up a few notches, because windows and icons will look like miniatures—and we're not happy with how Windows scales up right now.

That brings us to the refresh rate debate. For gamers, 60Hz IPS or TN panels are OK, but if you've ever played on a 120Hz panel with a powerful GPU pushing it, you know just how beautifully blur-free they can be. We dare say it, if we gamed more than we edited photos or videos, we'd take a pass on the lowly 60Hz panels. The problem with high-refresh monitors has been their pedestrian resolution of 1920x1080 in 24 inches. There are 120Hz 27-inch monitors as well, but their 1920x1080 resolution gives them a remarkably low pixel density of just 81 PPI. Asus thinks it has the gamer's ultimate fantasy monitor with its new ROG Swift PG278Q. This 27-inch TN monitor has a respectable resolution of 2560x1440 and a refresh rate of 120Hz. While its pixel density doesn't approach that of a 4K monitor, the 120Hz refresh may compensate for gaming purposes—for those with hefty GPUs.

For those with lesser graphics cards, though, the Asus Swift monitor also boasts Nvidia's new proprietary G-sync technology. (The Titan, 7-series, and several 6-series are supported in G-sync.) This tech syncs the monitor's refresh rate to the GPU's rendering, translating to smoother and sharper images, even if the frame rate dips below 30fps. G-sync, of course, won't work with AMD cards, but for gamers not hung up on color accuracy or off-axis viewing, the ROG Swift might be the ultimate monitor right now in the green camp. And yes, we know AMD has talked of FreeSync—the free method to sync refresh with GPU rendering. It's just not clear if FreeSync will work with desktop monitors yet, although it is promising on laptops, which are typically fairly low-powered in the graphics department.

What about a 120Hz panel that also runs at 4K? That's coming too, but remember that you'll need an inordinate amount of graphics grunt to push twice the pixels of a single 4K panel.

REPUBLIC OF GAMERS
THE CHOICE OF CHAMPIONS
ASUS

The Asus ROG Swift is the first 2560p monitor with a 120Hz refresh rate.

WHAT YOU'LL NEED TO RUN 4K

WE HOPE YOU GOT A HUGE TAX REFUND

YOU'LL NEED NEW CABLES

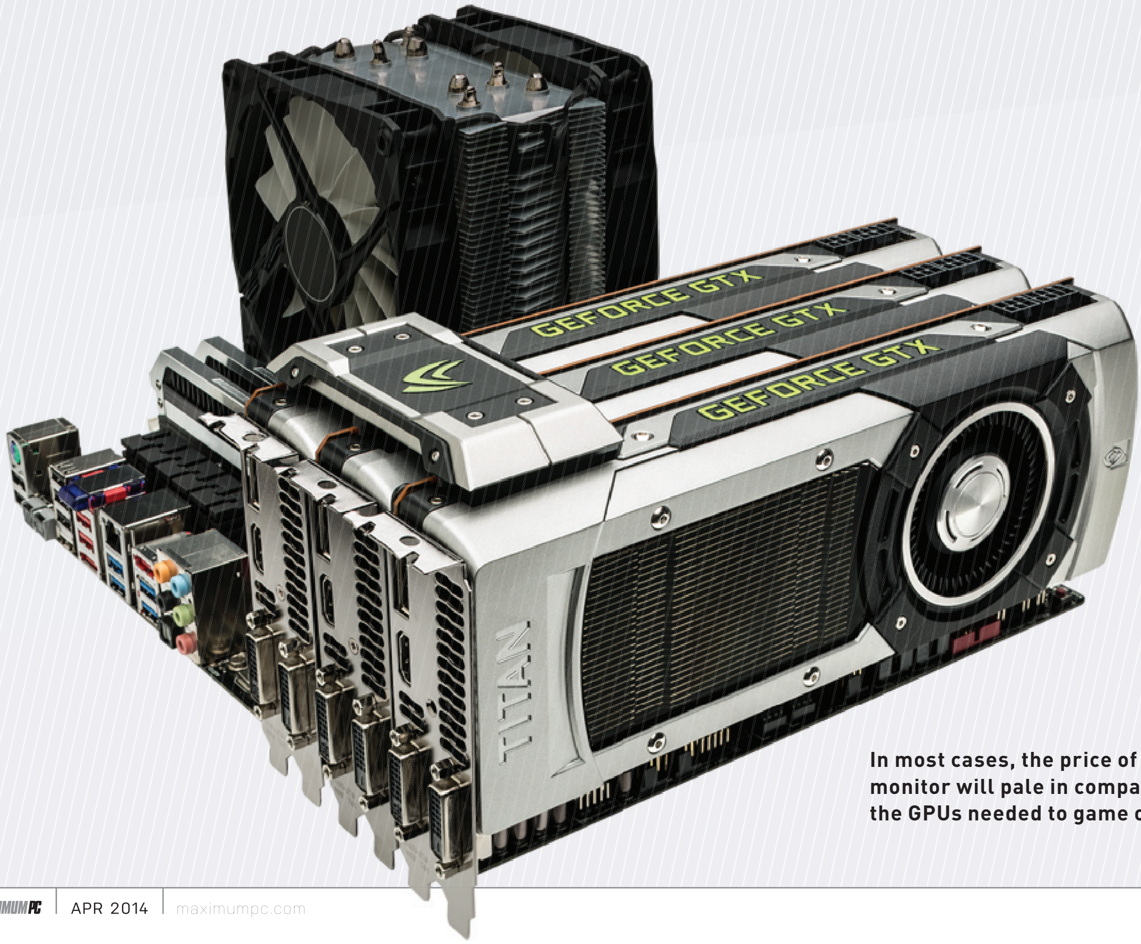
If you're like us and have been running DVI or dual-link DVI for the past—oh, we don't know, forever?—4K requires a different connection, as the Digital Visual interface tops out at 2560x1600 at 60Hz—far short of 4K's needs. To run 4K resolution, you will need to run either DisplayPort 1.2 or HDMI 2.0. For those on the DisplayPort train, version 1.2 is available today and will let you run 4K at 60Hz when using a Multi-Stream Transport (MST) mode. In MST mode, the graphics card generates several signals, or "streams," which are combined over the DisplayPort cable in order to run the panel at 60Hz. If you were to use a DisplayPort cable and run the panel in Single Stream Transport (SST) mode, you would top out at 30Hz. If you're more interested in running HDMI for some reason, it's more complicated. A single HDMI 1.4 connection is only able to hit 30Hz at 4K resolution, which is unacceptable. Some posters on our website have said "30Hz is fine for porn and web browsing," but we disagree. Just dragging a window around the screen causes it to shear and stutter in a manner similar to how it looks when you run your PC without graphics drivers installed. Some monitors and GPUs allow dual-HDMI connections to achieve the bandwidth needed, but it's a kludge and few support it. The fix for HDMI will come with HDMI 2.0, which will easily allow 60Hz at 4K, as well as multi-channel audio, but no monitor nor any GPU we know of currently has the new interface. So, be sure to verify what your panel supports before buying; if you get a 30Hz panel, you will be very, very sorry. And forget about trying to game on that thing.

THE MONITORS

We covered this topic on page 32, so we won't go into more detail here, other than to note we're still in the beginning stages of 4K monitor growth. Throughout 2014, you should see 4K panels offered from all the usual suspects. The good news is that prices have already dropped from the $3,500 mark down to under $1,000, and we expect many more manufacturers to be offering panels in this lower price range. Whether or not we'll get an affordable 4K IPS panel is a different story. Although, for gaming, TN is fine. The Dell 24-inch IPS panel is relatively affordable at $1,299—just don't expect to see it hit the $700ish prices of today's 27-inch and 30-inch panels until at least 2015, if not later.

THE GPUS

If you thought purchasing a 4K monitor was financially painful, you ain't seen nothing yet. That transaction was merely fore-



In most cases, the price of a 4K monitor will pale in comparison to the GPUs needed to game on it.

play for the real pain and suffering that will occur when you have to buy enough graphics firepower to run that display at its native resolution on today's games. As we stated earlier, Nvidia itself recommends at least two GTX 780 cards in SLI, so that's $1,000 worth of GPU, on top of the $800 to $3,500 for the monitor. The cheapest way to get into the 4K ballgame at this point would be to buy two Radeon R9 290 cards—assuming you can even find them for sale anywhere—which will set you back $800. Or you could get two GTX 780s, which will cost you roughly $1,000. You can pretty much forget about anything less powerful than these $400 to $500 GPUs though, as we can guarantee you they won't pack enough of a punch to drive a 4K display to anywhere close to 60Hz. Even the last generation of dual-GPU boards, such as the GTX 690 and Radeon HD 7990, aren't up to the ask on their own.

> “
> MOST OF TODAY'S HIGH-END GPUs ARE STILL NOT CAPABLE OF RUNNING 4K AT AN ACCEPTABLE LEVEL OF PERFORMANCE

4K BENCHMARKS

Before you look at the benchmark chart below, we recommend that you walk over to your PC and put a blanket over it. Seriously, it doesn't want to see you staring at these benchmark numbers. When you see how incompetent even the most high-end GPUs on the planet are for running 4K, it will probably make your PC seem, well, inadequate. What we mean is, look at these numbers. Even a $700 GeForce GTX 780 Ti can only hit 23fps in Unigine Heaven 4.0 with everything maxed out, and it hits only 19fps in Metro: Last Light. If there's one takeaway from this benchmark chart, it's this: Most of today's high-end GPUs are still not capable of running 4K at an acceptable level of performance. We're sorry, but that is a fact. Sure, all these games are playable—some more than others—but none of these cards, or combinations thereof, could hit 60fps in any of the games we chose for benchmarking. For this generation of GPUs, this is the reality.

Since 2014 is going to be the year of 4K, it's very likely that whatever is coming from AMD and Nvidia will be better equipped to handle this resolution, and we certainly hope it is. Nvidia's Maxwell GPUs are supposedly on track for a 2014 release, though we probably won't see a flagship board until Q3 or later. The company might also release a dual GK110 board named the GTX 790, but it won't be faster than GTX 780 SLI, so don't get your hopes up.

We've heard nothing about what AMD has up its sleeve, as we expect its Hawaii cards to have a long shelf life. The impending Mantle API update should give the cards a shot in the arm, so to speak. As with Nvidia, though, the current generation is barely capable of running 4K, so we can expect the next-generation cards to be much more capable. The good news is that by the time these newfangled cards arrive, we should have a whole flock of new 4K panels on offer, so it'll be glorious times for well-heeled PC gamers. ⏻

BENCHMARKS

	Nvidia GTX 780 Ti	Nvidia GTX 780	Nvidia GTX Titan	AMD Radeon R9 290X	AMD Radeon R9 290X Crossfire	Nvidia GTX Titan SLI	EVGA GTX 780 ACX SLI
Driver	332.21	332.21	332.21	13.12	13.12	332.21	332.21
Unigine Heaven 4.0 (fps)	23	23	21	18	17	**37**	30
Unigine Valley 1.0 (fps)	30	30	28	26	23	**37**	16
Tomb Raider (fps)	28	26	25	27	**52**	44	44
Metro: Last Light (fps)	19	17	17	18	**29**	26	26
Battlefield 4 (fps)	40	36	35	38	**64**	60	57
Batman: Arkham Origins (fps)	44	43	41	38	**66**	57	57
Hitman: Absolution (fps)	44	39	40	44	**75**	55	55

Best scores are bolded. Our test bed is a 3.33GHz Core i7 3960X Extreme Edition in an Asus Rampage IV Extreme motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 8. Our monitor is a 32-inch Sharp PN-K321. All games are run at 3840x2160 with no AA.

GEEK QUIZ

CLASS IS NOW IN SESSION—TIME TO GET SCHOOLED!

Our world is full of competitions and tournaments that favor impressive athletic feats and rippling abs. The winners get to wear fancy rings and get paid silly amounts of money to wear a shoe with a swooping logo on it. So where do geeks like us go if they prefer to flex the muscle of the mind? Where are the trophies for the legions of sons and daughters who tirelessly fix their parents' computers and educate countless laypeople about the dangers and wonders of technology? Er, sorry, we don't have any tangible rewards for you, either. But we do have a fun quiz!

Of course, "fun" might not be an accurate word for it. Our annual Geek Quiz is actually a crucible of pain and confusion that separates the wannabes from the war heroes; a baptism by fire, from which only the pitiless juggernaut will emerge unscathed. Basically, the Geek Quiz is like being thrown into the Thunderdome with your mother-in-law. (On the bright side, you can set the Geek Quiz on fire if it upsets you.) So, turn the page and begin your journey to the head of the class—or to huffing gas.

MAXIMUMPC
UNIVERSITY

1. The first consumer SSD to reach the 1TB range was:
A. Crucial M500
B. Samsung 840 Pro
C. OCZ Vector
D. Intel 530 series

2. The Nvidia GK110 die is 551 square millimeters—how big is AMD's "Hawaii" die?
A. 394 square millimeters
B. 438 square millimeters
C. 578 square millimeters
D. The same as the GK110—551 square millimeters

3. Tri-gate transistors are:
A. Used in Intel's 22nm Ivy Bridge processors
B. Used in AMD's Yorktown-class APUs
C. The basis of all Federation technology in the 23rd century
D. The smallest 3D circuit in the Sandy Bridge CPU series

4. The official TDP for the AMD Radeon R9 290X is:
A. 250 watts
B. 300 watts
C. 350 watts
D. AMD never stated TDP for this card

5. Valve's SteamOS is based on which Linux distribution?
A. Ubuntu
B. Debian
C. Penguin
D. Fedora

6. The average amount of data that can be written to an SSD before the flash wears out is:
A. 100TB
B. 50TB
C. 250TB
D. Not sure, we've never worn one out

7. How many transistors does the R9 290X GPU contain?
A. 8.2 billion
B. 6.2 billion
C. 7.7 billion
D. 5.8 billion

8. Which famous game developer left their company to join Oculus VR?
A. John Carmack
B. John Romero
C. Richard Garriot
D. Cliff Bleszinski

9. Just after Windows 8.1 hit the market, which computer manufacturer decided to re-release systems with Windows 7 preinstalled?
A. HP
B. Dell
C. Lenovo
D. Acer

10. USB 3.1 will have a maximum theoretical transfer speed of:

A. 1,000Mbps

B. 1Gbps

C. 10Gbps

D. 100Gbps

SanDisk
USB 3.0

ANSWERS: 1-A, 2-B, 3-A, 4-D, 5-B, 6-D, 7-B, 8-A, 9-A, 10-C

11. **AMD's low-level graphical API is known as what?**

A. Eyefinity

B. Crossfire

C. Powertune

D. Mantle

12. **Which of the following sports teams accept Bitcoin for ticket purchases?**
A. Oakland Raiders
B. Rockford Peaches
C. Sacramento Kings
D. Gotham Rogues

13. **Which of these is not a part of the newly announced HDMI 2.0 specification?**
A. 32 audio channels
B. 2160p (4K UHD resolution) at 60 frames per second
C. 6Gbps of bandwidth per channel
D. 3D 4K UHD display at 120 frames per second

14. **Intel's current high-end integrated graphics is known as:**
A. Optimus
B. Iris Pro
C. GCN
D. HD 4600

15. **Which of these PC games does not require an online connection to play?**
A. SimCity
B. Guild Wars 2
C. Diablo 3
D. PlanetSide 2

16. **The Nvidia Shield uses what system-on-a-chip (SoC)?**
A. Tegra 2
B. Catalyst
C. Tegra 4
D. Phenom Pro

17. **Which version of the Oculus Rift added positional head tracking?**
A. The 720p prototype
B. The 1080p prototype
C. The Crystal Cove prototype
D. The Bright Cove prototype

18. **When discussing monitors, the acronym "IPS" stands for:**
A. Interpolated screen
B. In-plane switching
C. Internal panel screen
D. Intrinsic polar system

19. **When an SSD's NAND flash wears out, you can:**
A. No longer access the data
B. Still access the data
C. The drive is read/write locked
D. No longer see the drive in the BIOS or OS

20. **Prior to working at Valve, VP of Public Relations Doug Lombardi worked for what company?**
A. Imagine Media
B. Apple
C. Microsoft
D. Intel

ANSWERS: 11-D, 12-C, 13-D, 14-B, 15-A, 16-C, 17-C, 18-B, 19-B, 20-A

21. What is the name of Microsoft's upcoming competitor to Apple's Siri voice assistant?

A. Cortana
B. Clippy
C. Ballmie
D. Microsoft Virtual Assistant Pro 2014

22. What type of NAND flash can hold eight different values per cell?

A. MLC
B. SLC
C. DLC
D. TLC

23. Which one of these Radeon GPUs does NOT support TrueAudio?

A. Radeon R9 290X
B. Radeon R9 290
C. Radeon R9 280X
D. Radeon R7 260X

24. Samsung's Rapid Mode for SSDs does the following:

A. Caches SSD data to an HDD for increased reliability
B. Caches SSD data to DRAM for increased performance
C. Combines your HDD and DRAM into a "virtual SSD" via caching
D. Allows you to use RAID with any SSD

25. In Windows, what is the keyboard shortcut to directly open the Task Manager?

A. Shift + Alt + Tab
B. Ctrl + Alt + Del
C. Ctrl + Shift + Esc
D. Alt + F4

26. Which of the following is not a new feature added in Windows 8.1?

A. Boot directly to the desktop
B. Reintroduction of the Start button
C. Run two Modern UI apps side-by-side
D. Native Blu-ray playback

27. An SSD has to erase and rewrite data at times before it can perform a write command. What is this called?

A. Over-provisioning
B. The Trim command
C. Write amplification
D. Write/Rewrite Function

28. Which of these crypto-currencies does not exist?

A. Bitcoin
B. Dogecoin
C. Sendcoin
D. Coinye West

29. How many 1080p screens do you need to display as many pixels as a single 4K monitor?

A. Two
B. Four
C. Five
D. Six

30. AMD's newest flagship GPUs uses silicon with what code name?

A. Malta

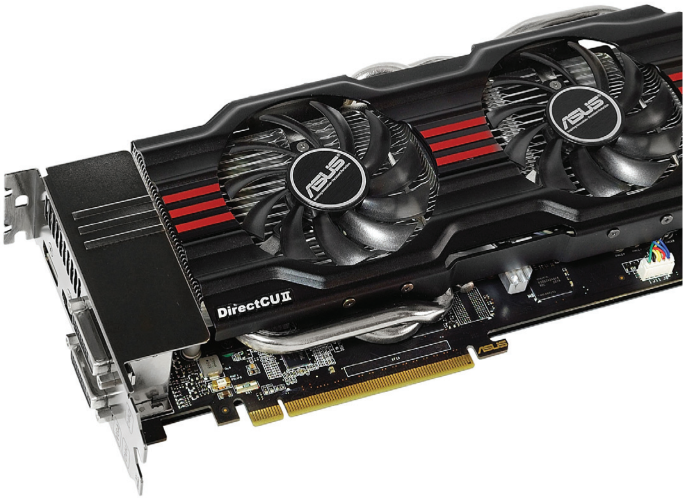
B. Tahiti

C. Vesuvius

D. Hawaii

RADEON
AMD
RADEON GRAPHICS

ANSWERS: 21-A, 22-D, 23-C, 24-B, 25-C, 26-D, 27-C, 28-C, 29-B, 30-D



31. **Which of the following GPUs has the highest Thermal Design Power (TDP)?**

A. HD Radeon 7950
B. GeForce GTX 680
C. GeForce GTX 770
D. The Radeon 7950 and the GTX 770 have the same TDP

32. **After installing Windows for the first time on a new PC, what does *Maximum PC* recommend be installed first (aside from LAN drivers)?**

A. Display drivers
B. Chipset drivers
C. Windows update
D. Discrete SATA drivers

33. **What is the sum of the stock clock speed of a Core i7-2600k, Core i7-3970x, and a FX-8350 (assume no Turbo Boost)?**

A. 9.5 GHz
B. 12.3 GHz
C. 10.9 GHz
D. 10.2 GHz

34. **Translate the following IP address: 11101111 11110111 11110111 11101111**

A. 193.224.224.193
B. 239.247.247.239
C. 234.239.234.239
D. 231.234.224.231

35. **The practice of wear leveling on an SSD involves:**

A. Continually deleting unneeded files to improve performance
B. Writing to a specific block only once per day
C. Wearing out specific blocks before writing to fresh ones
D. Spreading writes out over all the NAND

ANSWERS: 31-C, 32-B, 33-C 34-B, 35-D

THE DIFFERENCE BETWEEN GEEKS AND NERDS

Had it not been for the proliferation of computers and technology, the terms "geek" and "nerd" would still hold negative connotations. Fortunately for you, dear reader, "geek" now carries a more positive meaning, and no longer has a primary association with sideshow freaks who bite the heads off chickens (look it up). Instead, the world we inhabit today is largely powered by geeks and nerds, but what's the difference between the two? As experts on the subject, these are our thoughts on this ever-controversial topic.

While both parties possess a great deal of technical expertise, in our opinion the critical difference is their approach to social situations and their desire, or lack thereof, to interact with others. A geek, for example, generally will feel obliged to discuss their Geek Quiz results IRL, whereas their nerdy counterparts are more likely to boast to members of their guild or in an online forum. Not surprisingly, geeks are more extroverted and play board games like Magic: The Gathering, whereas nerds typically consume media that doesn't require human interaction.

As a by-product of losing themselves in geeky and nerdy pursuits, both parties gravitate toward highly specialized and technical fields. In the world of IT, nerds are highly skilled and often become software engineers, web developers, or programmers, designing applications and tools that geeks must then implement. Nerds are usually network or system admins, whereas geeks in IT tend to gravitate toward the front end as IT analysts, project managers, or consultants, based on their ability to speak geek.

Being a geek or a nerd isn't as glamorous as the mainstream media has portrayed it in movies like The *Social Network*, or even in the pages of *Maximum PC* magazine. But popular culture is redefining this generation's image of what it means to truly be in love with your craft, making the term “geek” synonymous with an obsession with a subject that lies somewhere outside the ordinary. That's good news for us, but for what it's worth, we're content to be labeled as Pure PC Power aficionados, thank you very much.

AD

36. **What material has the most efficient heat transfer?**

A. Aluminum

B. Copper

C. Adamantium

D. Thermal paste

37. **The average number of program/erase cycles for MLC NAND is typically:**
A. 1,000 cycles
B. 1,500 cycles
C. 3,000 cycles
D. 10,000 cycles

38. **Why use a silver coil in a water-cooling system?**
A. It's just for looks
B. It helps to prevent bacterial growth
C. It helps reduce temperatures
D. It's the next Bitcoin, so get it while it's cheap

39. **Which operating system was the first to support USB 2.0 out of the box?**
A. Windows 98 Second Edition
B. Windows Vista
C. Windows XP
D. Windows 2000

40. **What is the name of Windows 8's tile-based interface?**
A. Metro
B. Longhorn
C. Modern
D. RT

41. **Which of these technologies does Windows XP not use?**
A. USB 3.0
B. SATA 6Gb/s
C. DirectX 11
D. 802.11ac

42. **Which type of CPU architecture is Windows RT designed to be compatible with?**
A. PowerPC
B. x86-64
C. Cell
D. ARM

43. **The SATA 6Gb/s interface will be replaced by what interface?**
A. PCI Express
B. SATA Express
C. SATA 12Gb/s
D. SATA Next

44. **What does not belong?**
A. Haswell
B. Sandy Bridge
C. Westmere
D. Westeros

45. **True Audio technology is from:**
A. AMD
B. Creative Labs
C. Realtek
D. Sigmatel

46. **Which CPU claims the highest clock speed?**
A. Core i7-4770K
B. FX-9590
C. Athlon XP 3200+
D. Pentium 4 570

47. **NUC stands for:**

A. New Uniform Computing

B. Nu-cular, as in, “It’s pronounced nu-cular.”

C. Next Unit of Computing

D. No Unclear Computing

48. **Which CPU cannot be installed on a retail LGA 1150 motherboard?**

A. Xeon E3-1245 V3
B. Core i7-4770R
C. Core i3-4130
D. Pentium G3220

49. **Which of these is running an x86 CPU?**

A. Microsoft Surface RT
B. Microsoft Surface 2
C. Asus Transformer T100
D. Google Nexus 7

50. **Which of these isn’t available on Chrome OS?**

A. Netflix
B. Youtube
C. Yahoo Mail
D. Office 2013

ANSWERS: 36-B, 37-C, 38-B, 39-B, 40-C, 41-C, 42-D, 43-B, 44-D, 45-A, 46-B, 47-C, 48-B, 49-C, 50-D

GEEK POINT AVERAGE

Time's up, pencils down. It's time to emerge from the battle of the brain and survey the damage

0–12 CORRECT: SUNNYDALE HIGH DROP-OUT

Your results strongly resemble a smoking crater. Are you sure you've come to the right magazine? There, there, everything will be better soon. You should regain the use of your limbs and higher brain function in a few days.

13–24 CORRECT: MOS EISLEY COMMUNITY COLLEGE

You managed to avoid disaster, but our investigators have yet to determine how much of that was due to pure luck. You probably got a decent number of these correct on purpose, for which we had a commemorative pin, until the budget cuts.

25–37 CORRECT: CAL STATE HOGWARTS

We would find you tolerable in a party setting. You probably know a respectable number of *Matrix* and *Star Wars* references, and you can argue both sides of the robot slave-labor debate. But you're not quite ready to take the red pill.

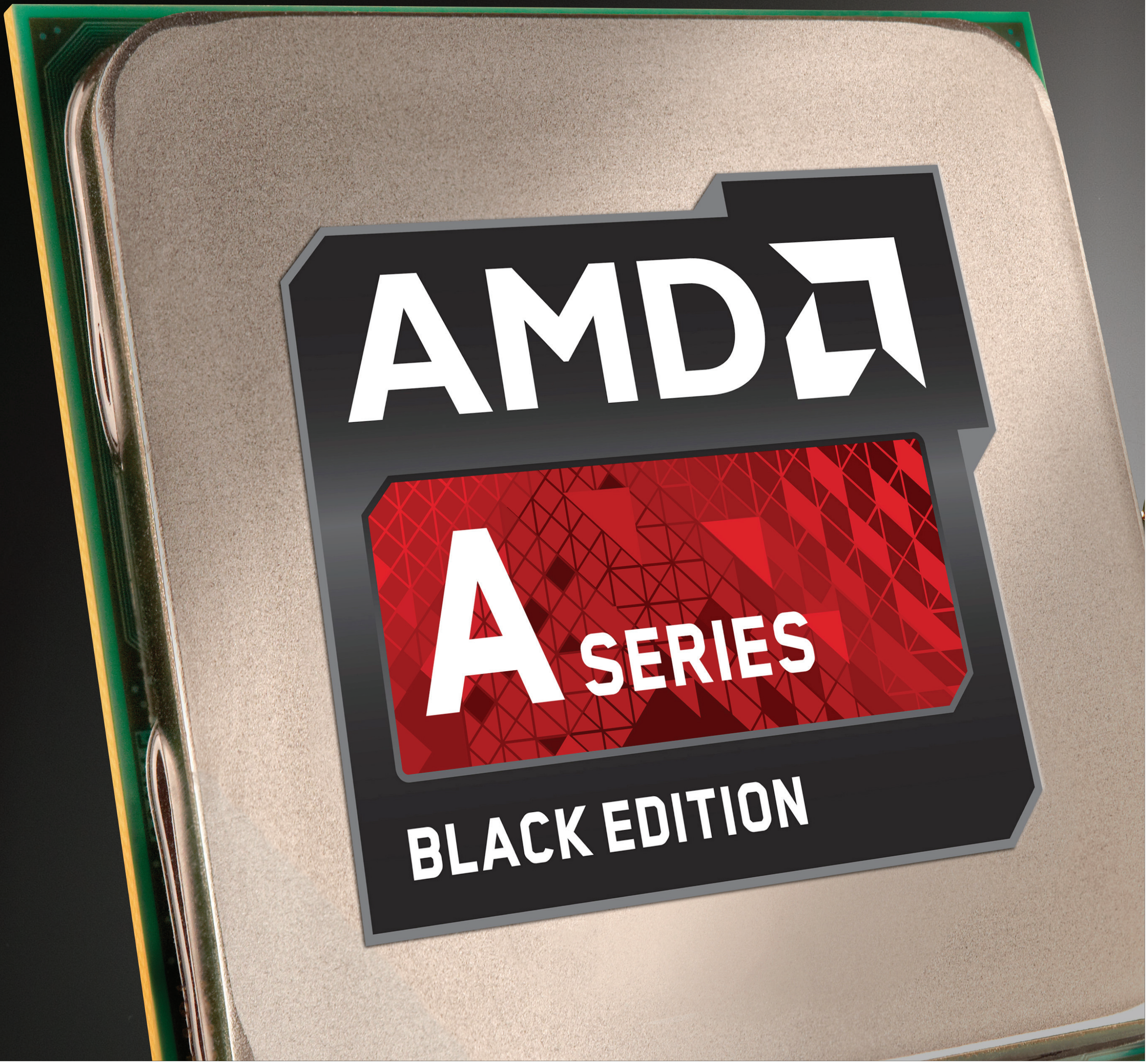
38–50 CORRECT: VULCAN INSTITUTE OF TECHNOLOGY

You completed the Kessel Run in ten parsecs (and you can argue why the use of “parsecs” is both right and wrong). Your knowledge is indisputably vast and mysterious, like an oil tanker that runs on neutrinos. We hope you are using your powers for good, and we tip our fedora to you.

THE AGE

(chorus) Heterogeneous System Architecture

BY GORDON MAH UNG

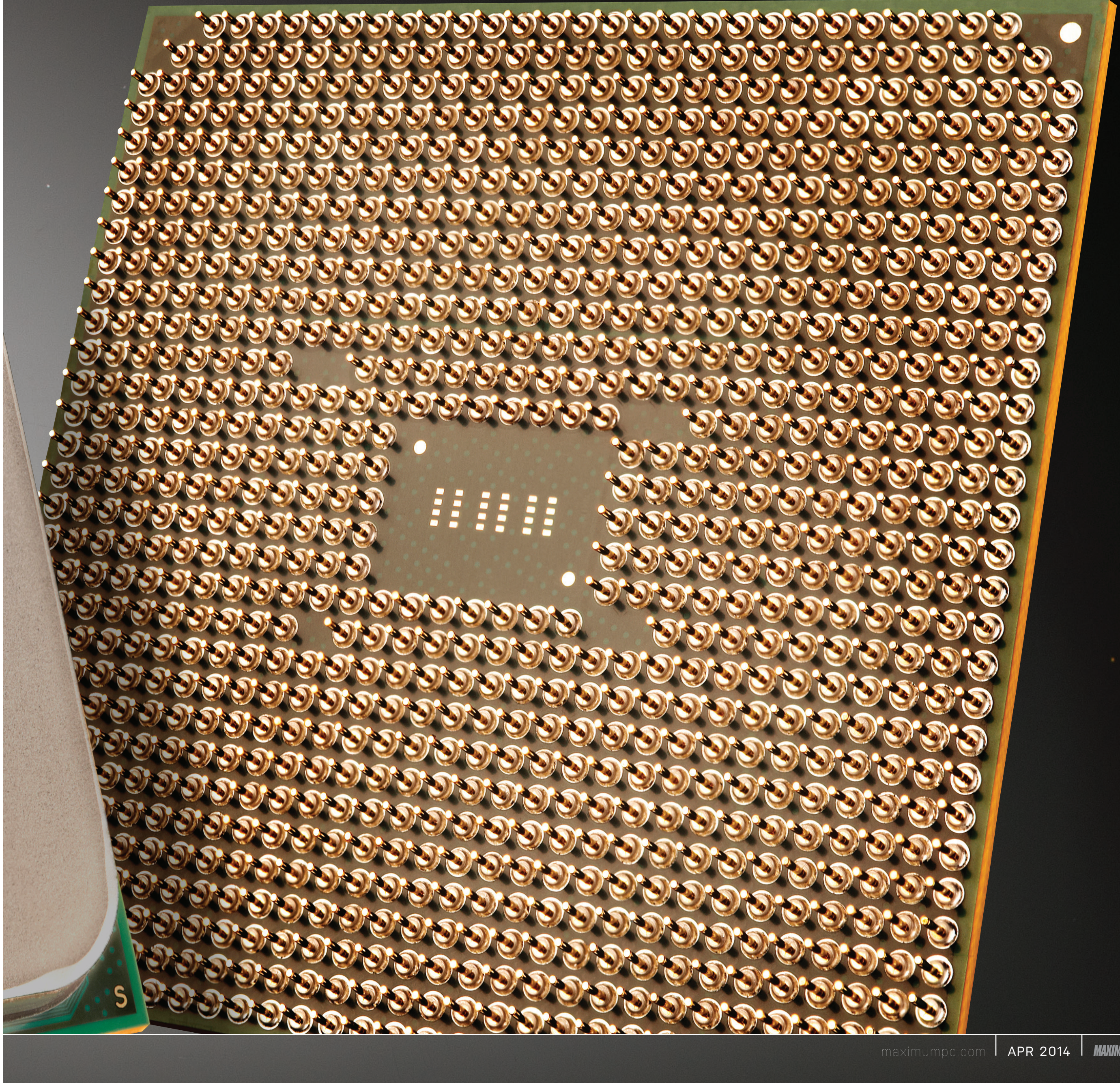

AMD
A SERIES
BLACK EDITION

OF HSA!

YOU'LL HAVE to forgive us, but it's hard not to think of AMD's next-generation APU without breaking into a chorus of that classic New Age song: "Age of Aquarius."

HSA does, after all, promise a brighter, sunshinier future for AMD's vision of Heterogeneous System Architecture—just without the hippies with long hair and bell bottoms dancing around. In short, HSA is the next step that finally melds the CPU and the GPU together.

Sound impossible? AMD's new "Kaveri" APU does just that, and to a level we've never seen before. But does this New Age APU really have what it takes to push off old-world designs from that *Mad Men*–dressed Intel? To find out, read on.



KAVERI ARRIVES

Heterogeneous System Architecture Explained

Let's be up-front about this: Kaveri's significance isn't that it's a super-high-end, tricked-out part that will rock everyone's computing world. No. This part won't and can't compete with a $1,000 Core i7 Extreme CPU or even a $500 Core i7 chip. Or, for that matter, a $320 Core i7, either. In fact, the chip is a mild-mannered, midrange APU. If your eyes are glazed over already, don't be quite so jaded. Kaveri is still a very significant milestone in AMD's quest to see heterogeneous computing turn into a reality.

If you flip back a few years, AMD had just gone through a run of phenomenal successes with its Athlon, Athlon XP, and Athlon 64, which had put its mortal enemy back on its heels for the first time in both companies' histories. That sleeping giant wouldn't stay asleep at the wheel forever, though. Those who know current events know that Intel came back with a roaring success with its Core CPUs.

As a tiny chipmaker, and one without a fab of its own, AMD's only real, true course was to use the one tool that Intel didn't have: graphics performance. While Intel has long been known as the king of not-good graphics and has received an Academy Award nomination for graphics unimpressiveness, AMD's GPU division hasn't always been in first, but everyone acknowledges the company has some good parts.

IT'S NOT JUST OLD INTEGRATED GRAPHICS

One thing you shouldn't confuse AMD's APUs with is the move to integrated graphics. Intel, in fact, combined a graphics core into the socket of its original LGA1156 CPUs before AMD, but that was just a GPU sitting inside the CPU package. The graphics core eventually was merged into the die itself, but the approach is far different than AMD's APU philosophy. Ever since the Llano APU was introduced in 2011, AMD has slowly been trying to elevate the integrated GPU to the same status as the CPU. Llano featured a few special interfaces between the cores and memory, Richland unified the CPU and GPU's north bridge, and Kaveri at last makes the GPU a full equal to the CPU.

HUMA

One of the biggest changes with Kaveri is the memory controller. With Richland, Llano, and other on-die or on-chip graphics parts, the CPU and GPU were still separate entities as far as the memory controller was concerned. In a Richland chip, for example, before the GPU could be tasked with working on something the CPU was processing, the information would have to be copied to the GPU's memory before work could begin—even though it was already in memory. It's a bit like two people working on a task simultaneously who must pass the materials over a wall before anything can happen. With Kaveri, both the CPU and GPU can access the same memory (up to 32GB) without the inefficiency of passing things back and forth first. Kaveri also features a queuing technique that lets either the GPU or CPU dispatch work loads. Thus, the GPU is finally getting top billing with the CPU rather than playing second fiddle.

Those aren't the only changes AMD made to Kaveri. On the x86 side, AMD has tweaked the new "Steamroller" cores to reduce mispredicted branches by 20 percent, reduce cache misses by 30 percent, and made general scheduling efficiency increases of 5 to 10 percent, the company claims. All this adds up to, AMD says, a healthy increase in efficiency over its previous "Piledriver" microarchitecture from 10 to 20 percent.

The basic fundamentals of the chip from A10-6800K are still there, too: It's a dual-core "module" with some shared resources. All three of the launch Kaveris feature two modules for a total of four cores. Of course, that gets into AMD's new language for Kaveri about just what a core is. The company says the new Kaveri actually has 12 "compute cores." Four of those are the CPU's, the other eight are the GPU cores. What's a compute core? AMD defines them as an HSA hardware block that's programmable and capable of running at least one process in its own context and virtual memory space, independently from other cores. Fortunately, AMD isn't pushing this line too hard and selling it to the public as a 12-core processor, but at least it's a somewhat defendable argument.

APU'S COMPARED

Make/Model	A10-7850K	A10-6800K	A10-5800K	A8-3850
Code name	Kaveri	Richland	Trinity	Llano
Microarchitecture	Steamroller	Enhanced Piledriver	Piledriver	K10
Core/Thread	4/4	4/4	4/4	4/4
Base/Turbo Clock	3.7/4	4.1/4.4	3.8/4.2	2.9/2.9
Die Size	245mm^2	246mm^2	246mm^2	228mm^2
Transistor Count	2.41 billion	1.303 billion	1.303 billion	1.178 billion
Graphics	R7	HD 8670	HD 7660	HD6550D
L2 Cache	4MB	4MB	4MB	4MB
Process technology	28nm	32nm	32nm	32nm
TDP	95 watts	100 watts	100 watts	100 watts
Price (at launch)	$173	$142	$122	$135

A NEW PROCESS THAT MAY NOT BE BETTER FOR CPUs

Kaveri gets a die shrink, going from Richland's 32nm process to 28nm process. The chip is still being made by AMD's former fab, Global Foundries, but there is a key difference. The 32nm process used a High-K Metal Gate Silicon On Insulator that's less dense than the 28nm Super High Performance (SHP) process used in Kaveri. The 32nm SOI process is better suited for higher-clocked CPUs—witness the cherry-picked AMD FX-9590 parts that could hit 5GHz out of a retail box. The 28nm SHP process (that's also used for GPUs) is denser but doesn't scale in frequency as easily as the 32nm process. That's apparent in these new parts, as the top-end 3.7GHz A10-7850K part Turbos up to 4GHz. In comparison, the older 32nm SOI-based A10-6800K had a base clock of 4.1GHz with a Turbo of 4.4GHz.

There will certainly be those who pooh-pooh such a decision, but the choice probably makes sense from AMD's perspective—it has basically chosen a process technology that's better suited to its core strength on the graphics cores rather than the CPU side.

IT'S DEAD, JIM

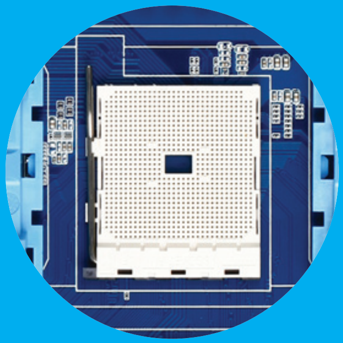
One thing the move to 28nm may signal certainly won't make AMD enthusiasts happy, though: The end of AM3+. There have been rumors swirling for months that the FX CPUs would be the final parts for the AM3+ socket. We'll point out that AMD has neither confirmed nor denied AM3+ and FX as dead, but between the leaked roadmaps that go nowhere for the high end and the 28nm Steamroller process so focused on denser transistors that don't favor building high-clocked CPUs, it doesn't look good. It also doesn't help that 2014 will be a transition year with DDR4 on the horizon. Does it make sense for AMD to really roll out a Steamroller using a process technology not optimized for pure CPUs that likely still won't compete with Intel's midrange parts, and then transition to DDR4? Painfully, we have to admit: no. Still, we really hope we're wrong, as we'd love to see an 8-core or more Steamroller hit the AM3+ just for old times' sake.

Don't take that to mean AMD will abandon the high-end enthusiast altogether, though. It just may be time for AMD to shed AM3+, and even those who have ridden the socket from AM2 till now really can't complain too much—the company should be patted on the back for providing a fairly smooth road over the years.

AMD'S NEW KAVERI LINEUP

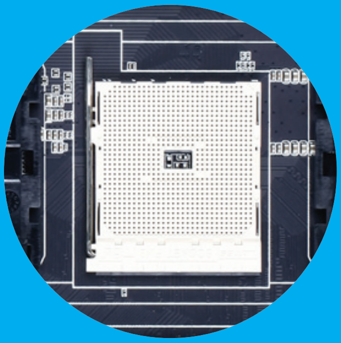
Make/Model	A10-7850K	A10-7700K	A8-7600	A8-7600
CPU Cores/ GPU Cores	4/8	4/6	4/6	4/6
CPU Base/ Turbo Clock	3.7/4	3.4/3.8	3.3/3.8	3.1/3.3
TDP	95 watts	95 watts	65 watts	45 watts
L2 Cache	4MB	4MB	4MB	4MB
Graphics	R7	R7	R7	R7
Shader Cores	512	384	384	384
Graphics Clock	Up to 720MHz	Up to 720MHz	Up to 720MHz	Up to 720MHz
Price	$173	$152	$119	$119

SOCKET TO ME



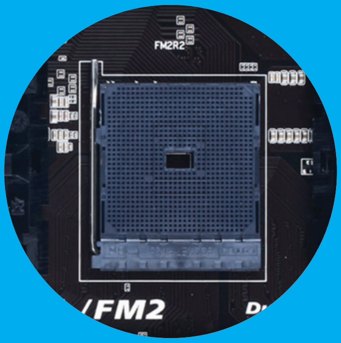
FM1

The original Socket FM1 was released alongside AMD's Llano APUs. We've lauded AMD over the years for socket stability, but not on FM1. Socket FM1 lived about a year and was made obsolete by Socket FM2. The worst part of it was the confusion on what worked with which part. To this day, we still have to look it up.



FM2

FM2 has been the modern APU socket we've grown accustomed to over the last year or so. It works with all A-series parts 5000 and greater, and even a few oddball Athlon II X4 parts, too. AMD is trying to wreck its legacy of socket support, though, by making Kaveri incompatible with existing FM2 boards. Fooey.



FM2+

Kaveri has a slightly different pin configuration than Richland and Trinity, and thus FM2+, or FM2b, was born. The good news is FM2+ boards will work with older A-series APUs 5000 or greater. The bad news is Kaveri won't fit into your existing FM2 motherboard.

BUT WAIT, THERE'S MORE

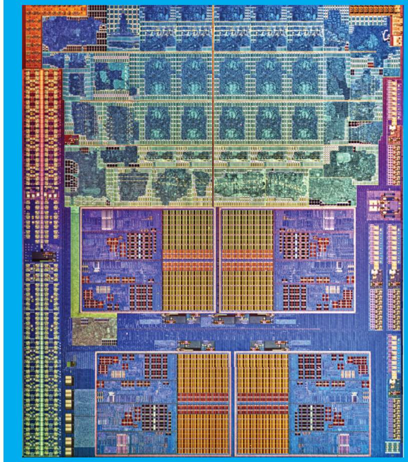
Mantle, TrueAudio get thrown in for free!

Besides a new process, microarchitecture, and uniform memory access, Kaveri also brings AMD's GCN graphics cores to the table. It's not just about the graphics cores, though, AMD has also wisely decided to bring AMD TrueAudio technology to the table. TrueAudio promises very advanced audio processing using the power of the graphics compute cores on hand. Kaveri will also benefit from AMD's new Mantle support. Mantle is AMD's new API that's designed to sidestep limitations in DirectX and promises insane performance increases. Interestingly, Mantle's main benefit may not be Dream Machine–level exotic rigs with overclocked hexa-cores. Instead, Mantle looks to benefit those with far more modest CPUs. You know, such as an A10-7850K. Using the Mantle API, a Core i7-4960X with a Radeon R9 290X would see a modest 1.4 percent improvement at 2560x1600, but that same GPU paired with a lower-end A10-7700K would see an astounding 40.1 percent buff using Mantle, AMD claims.

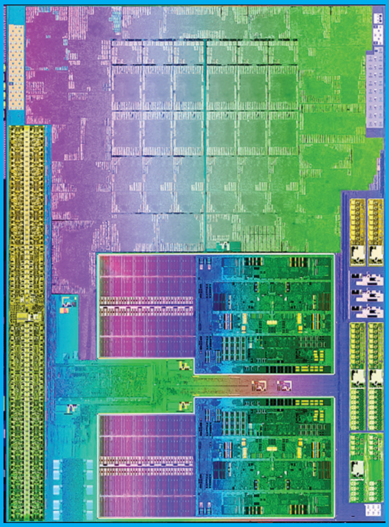
Earlier, we said it was wise of AMD to include Mantle and TrueAudio in Kaveri. We believe it was a smart decision because the company needs to get more chips on the ground that support Mantle and TrueAudio for either to gain any real traction. Putting it into the very affordable Kaveri accomplishes that. The last piece, which is the icing on the cake, is the ability to run the graphics cores to mine crypto-currency. How much you can make varies on what you're mining, how much power you're paying for, and the market value, but one crazy figure AMD officials threw out there was a Kaveri APU could potentially generate $704 yearly in crypto-currency (or more, and also less, too).

> A KAVERI APU COULD POTENTIALLY GENERATE $704 YEARLY IN CRYPTO-CURRENCY

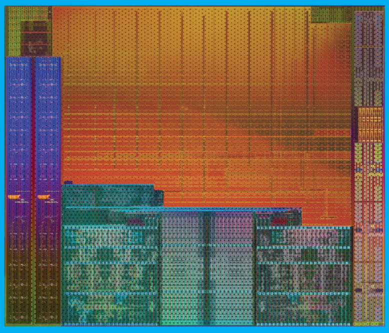
THE EVOLUTION OF APUs



LLANO
The original Llano APU used the same basic K10 cores as Phenom II CPUs. Though it didn't come out until 2011, AMD had been working on the Llano concept since 2006—soon after its purchase of ATI. Rather than the dual-core modules, Llano used four distinct CPU cores alongside the Radeon HD 6000–class graphics.



TRINITY
The second-gen APU used AMD's newer Piledriver dual-module cores, added a Turbo Core mode, and faster Radeon HD 7000–class graphics. A second iteration of the Piledriver APU was called Richland and added mostly power and clock improvements.



KAVERI
Kaveri breaks from previous APUs by allowing both CPU and GPU cores to use the same memory without having to copy the data back and forth. The newest APU also bring R7-class graphics to the mix.

HOW WE TESTED

Kaveri comes in three flavors but we think the most interesting of the bunch is the Cindy Brady model: the A8-7600 part. While the high-end APU sounds enticing, at $173 it's pretty close to a quad-core Haswell chip. And yeah, no one cares about Jan. Far more palatable is the A8-7600. For $119, the A8-7600 does what AMD does best: compete on price. The A8-7600 is also unique among the Kaveris because you can easily set the CPU via BIOS to run at either a 45 watt TDP or at 65 watt TDP. At 65 watts, the base is 3.3GHz with a Turbo of 3.8GHz, and at 45 watts the base is 3.1GHz with a mild Turbo of 3.3GHz. We tested ours at 65 watts.

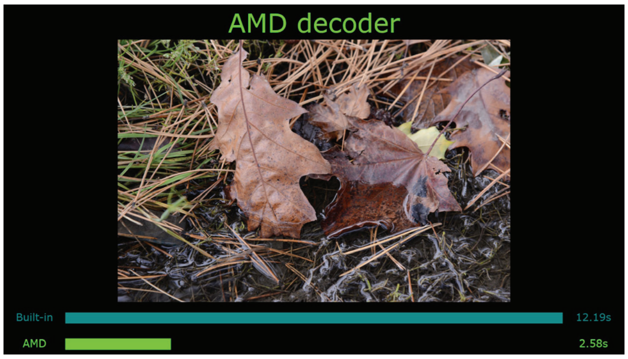
The A8-7600 went into an Asrock FM2A88X-ITX+ mobo running a Samsung 840 SSD. Before we get into test results, we'd like to point out a sleight of hand AMD performed this time around with the benchmarks it showed off to the public. The AMD part shows benchmarks using 16GB of DDR3/2133 and the Intel system using 16GB of DDR3/1600. That's not fair. For our testing, we outfitted our Intel chips with dual-channel DDR3/1866 of G-skill RAM. We also obtained a pair of DDR3/2133 SO-DIMMs from G-skill, but the density was a bit lower at 8GB total. In the end, we tested all of our Intel parts using 16GB of DDR3/1866 and also tested the Kaveri at DDR3/2133 *and* DDR3/1866. Our testing shows that if you have Kaveri, it's probably worth paying for DDR3/2133.

All of our Intel testing was done using an Asrock Z87-M8 motherboard. It's also a Mini-ITX board but uses SO-DIMMs rather than DIMMs, hence the problem with getting 16GB of DDR3/2133. Our Intel box was outfitted with a Corsair Neutron SSD. Both platforms were loaded with a clean install of Windows 8.1, the boards flashed with the latest BIOS, and integrated graphics was used all around. For our Intel contestants we reached for a 3.4GHz Core i3-4130, which sells for $117. We also threw in a 3GHz Core i5-4430 part, the cheapest quad-core Haswell at $182; we include it only as a point of reference.

In choosing our benchmarks, we grabbed a subset of our typical CPU tests and threw in GPU compute and gaming workloads to give the integrated graphics a decent workout. We also added in an HSA JPEG decompression demo that AMD provided. Yes, we'll say that again—AMD provided it, so stop your belly-aching, Intel fanboys. We wanted to put it into the mix to see how the new Kaveri would do when something was made to exploit the capabilities of HSA.

THE RESULT

In many ways, not much has changed. Clock for clock, core for core, the AMD parts don't equal their modern Intel competitors when it comes to today's applications. The quad-core Core i5-4430 has a steep advantage over the AMD quad-core A8-7600 in multi-threaded tasks. This shouldn't be news to anyone, as AMD's current CPUs and APUs use dual-chip modules that share resources. Although the instructions per clock (IPC) is better than before, it's not enough to bridge the gap with an Intel part. Yeah, we know. You're thinking "who cares, that's a $182 CPU against a $119 CPU." We'd agree. Well, until you look at many of the benchmarks from the dual-core Core i3-4130 part. Thanks to its Hyper-Threading and better core efficiency, it's damn near a tie with the AMD part even with its four physical, albeit shared, internal cores.



AMD's JPEG decompression demo is built to show off the advantages of Kaveri's GPU and CPU to access the same memory.

In the X264 HD 5.01 encoding test, for example, the dual-core Core i3 does a good job keeping up and even passing the A8-7600. Remember, this is two cores against four cores. While Kaveri does OK with encoding, Haswell will generally be well ahead. We also ran through the new PCMark V2 test, which now features OpenCL support. The results weren't too surprising: When set to load up the GPU, the AMD part won; when run in conventional (aka CPU) mode, the Intel part jumped in front. As part of our testing, we also threw in some older tests, such as Valve's Particle Test. This primarily tests how a chip will handle theoretical game physics. More threads and more cores are better, and the Intel part was clearly the winner. The Core i3 also aces the AMD chip in Cinebench 11.5, which is a 3D rendering test. Again, we're talking about a dual-core vs. AMD's quad-core part, but maybe that old way of thinking is about as antiquated as judging CPUs based on clock speed. We don't, for example, compare a 3GHz Core i5 to a 3.4GHz A10 chip and automatically assume the A10 part is faster. Looked at that way, the A6-7600 does OK. In purely CPU tasks such as 7-Zip for file compression and TrueCrypt for encryption, both parts are dead even. For AMD CPUs, that's really not bad.

Fortunately, the AMD part gets payback where you'd expect: graphics. The A8-7600 offers significant performance boosts over the Intel HD4400 and HD4600 in the quad-core Intel Haswell chip. In Firestrike, the graphics boost is almost double that of the Intel dual-core. Tomb Raider also favored the AMD part. You could almost play Tomb Raider (with enough graphics tweaks) at a reasonable frame rate, too. In GPU compute, the Kaveri also represents well, generally acing the dual-core Haswell. In the one HSA test we ran, Kaveri showed a healthy performance boost over the Intel parts—in line with the promises of HSA, if you believe them.

We can't say all this without some caveats, though. The first is that when we pushed the GPU compute workloads from the graphics cores to the CPU cores, the AMD did pretty poorly. AMD's argument, however, is that the future is about GPU computing and HSA. Even if Intel's next-generation chip hits it out of the ballpark, the improvement isn't going to be more than maybe 25 percent, the company would argue. But by moving the same workload to the GPU, it's possible see performance gains of several magnitudes. That's the sales pitch, anyway, and though it sounds good, we know that hanging performance on developer support is a very long fight. Anyone hoping that native HSA apps will be a game-changer should burst that bubble now—it'll be years, if ever, before that happens. Think back to when Intel introduced the Pentium 4: Remember the huge stink around porting existing code to the new chip? As hard as Intel tried, it could never overcome the huge library of legacy applications that performed from bleak to mediocre on the P4. The lesson the company learned was that you can't "recompile the world."

The other issue with Kaveri is that it's main advantage is in graphics. Once you plug in even a $100 GPU, you neutralize the value of the APU but you're still stuck with the meh performance of the AMD compute cores. Fortunately, Kaveri is generally acceptable, but the power of those Haswell core's can't be ignored—Kaveri's four cores just about equal two Haswell cores.

THE UPSHOT

Kaveri's role is perfect in a box that is unlikely to ever see a real discrete graphics card, such as an ultra-budget rig or a NUC-style machine. That's the cheapest Kaveri, though. Once you get into the $150 and $175 range, you're fighting with the faster quad-core Haswell parts, and we'd temper our verdict with those matchups. The A8-7600 is in a very nice spot, though. It's far faster than its Intel contemporary in graphics, and generally "just good enough" on x86 performance so people aren't likely to care too much. We'd honestly have to call that a victory. ⏻

BENCHMARKS

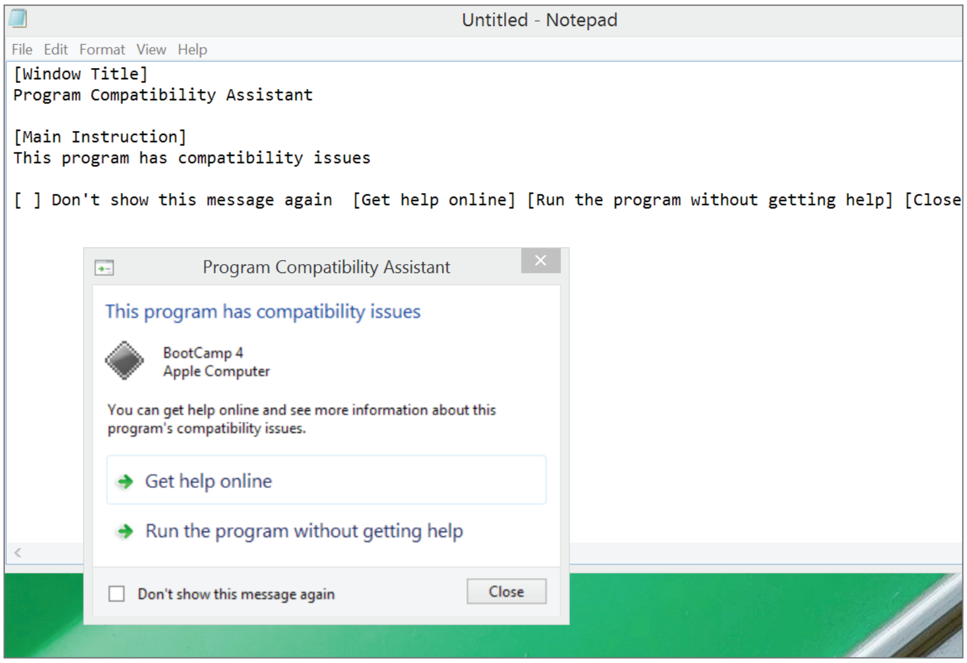
CPU	**A8-7600**	**Core i3-4130**	**A8-7600** (for reference only)	**Core i5-4430** (for reference only)
Graphics	R7	HD4400	R7	HD4600
Clock	3.3GHz/3.8GHz	3.4GHz	3.3GHz/3.8GHz	3GHz/3.2GHz
RAM Clock	DDR3/1866	DDR3/1866	DDR3/2133	DDR3/1866
Price	$119	$117	$119	$182
X264 HD 5.01 Pass 1 (fps)	34.2	**39.5**	34.6	50.4
X264 HD 5.01 Pass 2 (fps)	**8**	7.62	8	11.6
PCMark 8 V2 Home Accelerated	**3,102**	2,864	3,164	2,883
PCMark 8 V2 Home Conventional	2,502	**2,863**	3,422	2,880
Valve Particle Benchmark (fps)	82	**101**	82	126
Cinebench 11.5	3.36	**3.68**	3.4	5.06
TrueCrypt 7.1a (GB/s)	**2.1**	2	2.1	2.5
7-Zip 9.20 (mips)	**10,499**	10,423	10,888	14,046
JPEG Decoder CPU (sec)	12.14	**9.46**	11.62	10.04
JPEG Decoder GPU (sec)	6.06	N/A	5.63	N/A
Basemark CL 1.1 GPU	**64.2**	35.8	66.5	44.4
Basemark CL 1.1 CPU	2.66	**8.7**	2.7	11.8
LuxMark 2.0 Room GPU	**220**	177	230	176
LuxMark 2.0 Room CPU	72	**165**	119	328
Tomb Raider Norm 19x10 (fps)	**26.1**	16.1	28.2	19.7
Tomb Raider Low 19x10 (fps)	**36.7**	23.4	40.8	31.1
Tomb Raider Norm 16x10 (fps)	**30**	18.6	32.4	22.3
Metro: 2033 12x7 (fps)	**39.33**	18.3	43.95	31.67
Hitman 12x7 (fps)	**33.1**	25.1	36.1	27.8
3DMark Ice Storm	**57,581**	44,008	59,761	51,177
3DMark Ice Storm Graphics	**71,752**	44,844	76,442	52,722
3DMark Ice Storm Physics	34,048	**41,315**	33,854	46,417
3DMark Cloud Gate	**6,141**	5,074	6,335	6,191
3DMark Cloud Gate Graphics	**8,925**	5,819	9,464	7,099
3DMark Cloud Gate Physics	2,936	**3,504**	2,937	4,277
3DMark Fire Strike	**1,265**	661	1,325	774
3DMark Fire Strike Graphics	**1,370**	715	1,434	848
3DMark Fire Strike Physics	4,210	**5,028**	4,200	5,869

Best scores are bolded. Windows 8.1 and integrated graphics were used for all testing.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP OF THE MONTH


Untitled - Notepad
File Edit Format View Help

```
[Window Title]
Program Compatibility Assistant

[Main Instruction]
This program has compatibility issues

[ ] Don't show this message again  [Get help online] [Run the program without getting help] [Close
```

Program Compatibility Assistant

This program has compatibility issues

BootCamp 4
Apple Computer

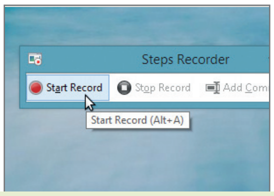
You can get help online and see more information about this program's compatibility issues.

Get help online
Run the program without getting help
☐ Don't show this message again
Close

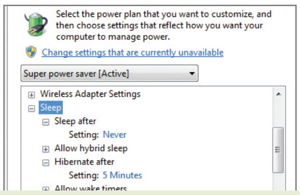
COPY ERROR TEXT TO YOUR CLIPBOARD

If you've ever wanted to look up a problem you're having in Windows, you might have been frustrated to find that you can't highlight text in the standard Windows error box. Here's a little secret: You can still copy the text—just make sure the error box is the active window, and hit CTRL + C. The box's text will be automatically copied to your clipboard.

MAKE - USE - CREATE



62
Set up and run a virtual help desk



Select the power plan that you want to customize, and then choose settings that reflect how you want your computer to manage power.

Change settings that are currently unavailable

Super power saver [Active]

- Wireless Adapter Settings
- Sleep
  - Sleep after
    - Setting: Never
  - Allow hybrid sleep
  - Hibernate after
    - Setting: 5 Minutes
  - Allow wake timers

65
Make your PC more power-efficient

ALEX CASTLE
CONTRIBUTING EDITOR

THREE VERY HANDY CHROME EXTENSIONS

WE WRITE ABOUT browser extensions from time to time, but not nearly often enough to keep up with the constant flood of great new browser utilities. Here are three extensions that I've recently started using, and already can't live without.

NiftySplit This isn't the only extension that shows you two tabs side-by-side in a single browser window, but it's the one that best suits my workflow. Your active page stays open in the left side of your browser, while any links you click open in the right, making this extension great for use with link-heavy sites.

Strict Workflow I find I get a lot more done using distraction-blocking extensions. My favorite right now is Strict Workflow, which blocks distracting sites for chunks of 25 minutes at a time—just long enough to get to work!

The Great Suspender If you tend to open dozens of tabs at once, RAM usage can become an issue in Chrome. The Great Suspender automatically suspends tabs you aren't using, freeing up valuable system resources.

↘ submit your How To project idea to: comments@maximumpc.com

Set Up a Virtual Help Desk

YOU'LL NEED THIS

WINDOWS 7 OR NEWER

A SOLUTO ACCOUNT
To remotely diagnose problems using Soluto, set up a free account: www.soluto.com.

I HAVE YOU EVER TRIED to troubleshoot a PC problem over the phone? The experience can be frustrating—not just for you, the expert, but also for the inexperienced user at the other end of the line. For a novice user, simply describing the problem they're having can be difficult, and executing a complicated fix harder still.

In this article, we'll show how anyone can use a built-in Windows utility to easily record a problem they're experiencing, or to create a step-by-step guide for fixing it. For more difficult issues, we'll show you several ways to take control of a friend or family member's PC, so you can fix the problem for them. **–MAYANK SHARMA**

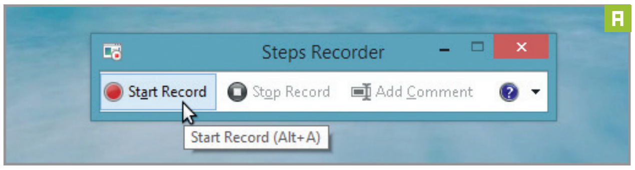
1 USE WINDOWS STEPS RECORDER First, we'll talk about Steps Recorder, a nifty little app included with recent releases of Windows to streamline the process of reporting and resolving issues. It's a troubleshooting and assistance utility that is, in effect, a combination of three tools: a keylogger, a screenshot utility, and an annotation tool. Steps Recorder comes in handy for documenting errors that can be reproduced. Using the tool, you can retrace the exact steps that led to the trouble.

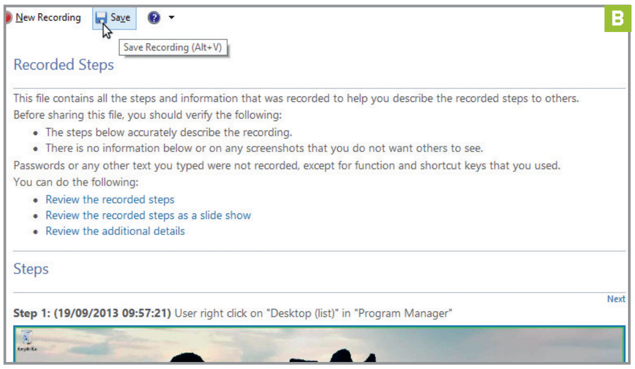
» The tool automatically takes screenshots that you can annotate, and logs details about the system, including the names, locations, and versions of all the apps that you access. It then packages the recording in an easily transportable file, which can be sent to an experienced user, who can then retrace the steps to assist in resolving the issue.

» In order to use the Steps Recorder, the person having a PC problem needs to type "record" in the Windows 8.1 Start screen and launch the tool. The tool is a small window that has controls to record your desktop session. Click "Start Record" to begin capturing the desktop (**Image A**).

» Now, they should perform the same steps that result in the problem. While recording, every mouse click takes a screenshot, and the "Add comment" button can be used to describe the problem in detail. There are also buttons to pause and resume recording.

» When they're done, they should click the "Stop Record" button. The tool enables them to review the recorded information (**Image B**) and then prompts for a name and location to save the recording, where it's saved as a zip file.





Recorded Steps

This file contains all the steps and information that was recorded to help you describe the recorded steps to others.
Before sharing this file, you should verify the following:

- The steps below accurately describe the recording.
- There is no information below or on any screenshots that you do not want others to see.

Passwords or any other text you typed were not recorded, except for function and shortcut keys that you used.
You can do the following:

- Review the recorded steps
- Review the recorded steps as a slide show
- Review the additional details

Steps

Next

Step 1: (19/09/2013 09:57:21) User right click on "Desktop (list)" in "Program Manager"

2 USE THE WINDOWS REMOTE ASSISTANCE FEATURE Unfortunately, some computer problems might be too unpredictable to record with the Steps Recorder, or the solution may be too complex for you to describe through an email or over the phone. For resolving such issues, you need the Windows Remote Assistance feature. Using this tool, anyone can be invited to take over the misbehaving computer, via the internet. The invited expert can then view the desktop of the malfunctioning machine and even take control of it and operate it remotely to sort out the problem.

» However, before that can happen, the person you wish to help must ensure that their computer is set up to be accessed remotely. To do so, they should search for "remote" in the Windows 8.1 Start screen, then in the Settings results list, click on "Allow remote access to your computer." This takes them to the Remote tab under System Properties. Here, they need to make sure that the "Allow Remote Assistance connections to this computer" checkbox has been selected.

» While they're here, if you plan on using the Windows Remote Desktop Connection tool (more on this later), they should also select the "Allow remote connections to this computer" option.

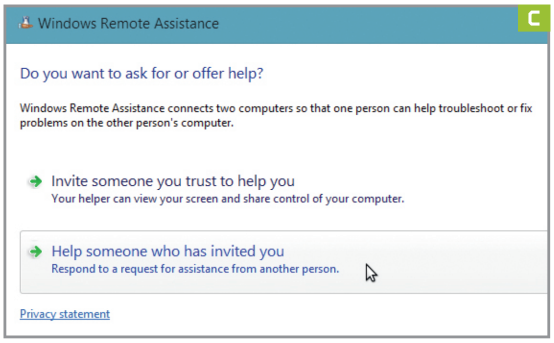
» Once their PC is accepting remote assistance connections, they can invite others to help. To put out a call for help, they should fire up the Windows Remote Assistance tool: Type "assist" in the Windows 8.1 Start screen, and in the Settings results list, select the "Invite someone to connect to your PC and help you, or offer to help someone else" option.

» Windows 8.1 now prompts with a "Do you want to ask for or offer help?" dialog. Here, they need to select the "Invite someone you trust to help you" option. They are now given three different options for sending out the invitation: save the invitation as a file that can be sent via Windows Live Messenger, email the invitation directly, or use Easy Connect.

» Easy Connect is a mechanism for connecting two computers for the purpose of providing remote assistance. The option to connect via Easy Connect is available only if both computers are running Windows 7, 8, or 8.1. There is no need to send out an invitation. The person requesting assistance is shown a 12-character password, which they must then pass on to the person who is offering them assistance.

» On your end, search Settings for "assistance" and then click "Invite someone to connect to your PC and help you, or offer to help someone else" (**Image C**). Selecting this opens up the Windows Remote Assistance wizard for you. Now, click "Help someone who has invited you," which shows you a list of people you've helped before. Because this is the first time you're using the program, you won't see any names; click "Help someone new" (**Image D**).

You now need to select a way for connecting to your friend's computer. If you're both using Windows 7, 8, or 8.1 on your machines, use the Easy Connect option (**Image E**) and type the password your friend has shared with you. Once you're connected, you can view your friend's desktop (**Image F**). You can use the "Chat" button to exchange text messages with your friend. If you need to take control of their machine, use the "Request control" button.

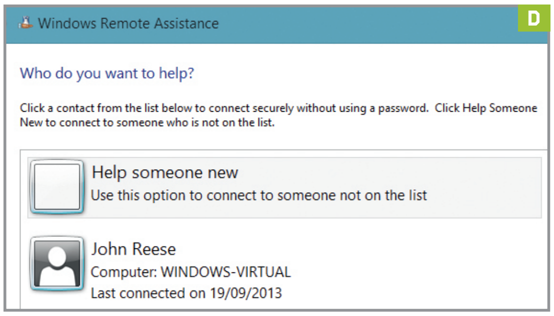


Do you want to ask for or offer help?

Windows Remote Assistance connects two computers so that one person can help troubleshoot or fix problems on the other person's computer.

Invite someone you trust to help you
Your helper can view your screen and share control of your computer.

Help someone who has invited you
Respond to a request for assistance from another person.

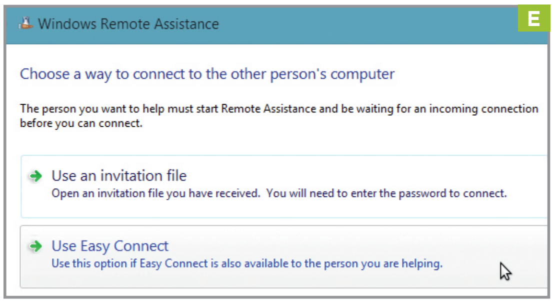


Who do you want to help?

Click a contact from the list below to connect securely without using a password. Click Help Someone New to connect to someone who is not on the list.

Help someone new
Use this option to connect to someone not on the list

John Reese
Computer: WINDOWS-VIRTUAL
Last connected on 19/09/2013

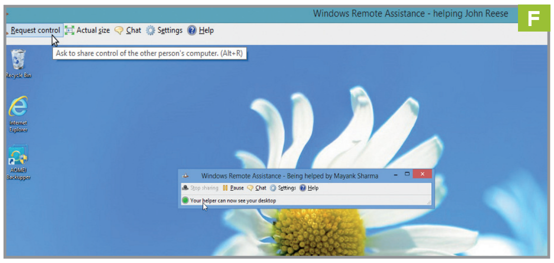


Choose a way to connect to the other person's computer

The person you want to help must start Remote Assistance and be waiting for an incoming connection before you can connect.

Use an invitation file
Open an invitation file you have received. You will need to enter the password to connect.

Use Easy Connect
Use this option if Easy Connect is also available to the person you are helping.



Ask to share control of the other person's computer. (Alt+R)

Your helper can now see your desktop

3 TAKE CONTROL USING WINDOWS REMOTE DESKTOP CONNECTION The Windows Remote Assistance tool is best suited for solving one-off queries. If you regularly need to help the same person with computer problems and guidance, you're better off using the Windows Remote Desktop Connection tool. Accessing a computer by establishing a Remote Desktop Connection works as if you're sitting right in front of that computer, allowing you immediate access so that you can enter commands and make fixes.

» To launch the tool, type "remote" in the Windows 8.1 Start screen and select the Remote Desktop Connection app. Now, click "Show options" to set up the tool. The Remote Desktop Connection tool has a very extensive multi-tab configuration panel. In the General tab, enter the name of the remote computer that you wish to connect to. In the username field, you need to enter the username of the user who has administrator privileges on the remote machine. You're prompted for their password when connecting.

» When you've entered all the necessary details, click "Connect" to establish a connection with the remote machine. You're then prompted for the credentials of the remote user you specified. Ignore any certificate errors and choose to establish the connection. When connected, the remote desktop appears as per the display settings.

» Finally, a couple of quick tips. When someone invites you to help them, if the invitation attempt fails, check whether their firewall is blocking connections. They can also click "Troubleshoot" on their end and follow the instructions to resolve the issue.

» If bandwidth is a problem when using the Remote Desktop Connection tool—which it might be if you're dealing with a 1080p monitor—you can switch to the Display tab and reduce the resolution of the remote machine.

4 TROUBLESHOOT REMOTELY WITH SOLUTO There are also lots of third-party tools for remotely accessing a machine. Soluto is designed to flag and troubleshoot common issues on remote PCs. With Soluto, you can manage a bunch of PCs, and the scanner you install on the machines you are supporting flags any potential issues.

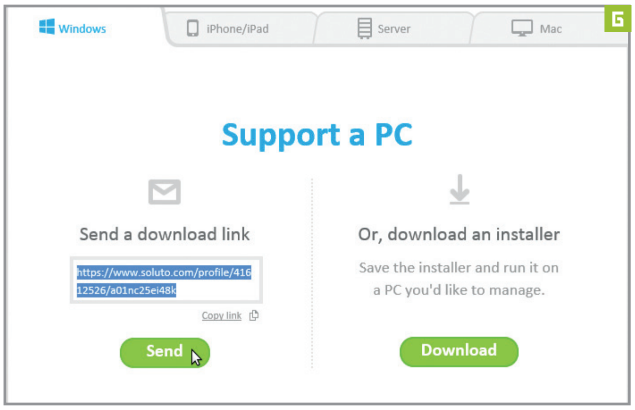
» To get started, head to www.soluto.com and create an account with the service by using your Facebook or email details. After logging in, you're taken through a getting-started wizard. You can safely skip all the steps in the wizard and go straight to your Soluto dashboard.

» You can now start adding devices. Click "Add PC/iPhone/iPad" in the dashboard and then select the appropriate tab for the type of device you want to add (**Image G**). You can add a friend's Windows PC by sending them an email from here.

» Soluto sends an email to your friend, with a link to download the Soluto scanner onto their machine. The software informs you once your friend has accepted your request to assist them and downloaded the software. (This might be a good time to remind your friend or relative that under normal circumstances, they should never install software just because an email tells them to.)

» In the Soluto dashboard, you can now click on your friend's machine to analyze it in detail (**Image H**). (For the purpose of this how-to, we remoted into a virtual machine.) Soluto informs you about the available resources on the remote machine and whether there are any updates available for the installed apps, and even lets you install more.

» The best thing about Soluto is that it flags any issues it encounters. For example, it lets you know if it finds any apps that are slowing down boot time and can be safely turned off (**Image I**), or if the hard disk needs to be defragmented. You can also access the remote computer, which displays its desktop in your web browser. By default, Soluto asks for permission from your friend before sharing their desktop, but if they want, they can allow you to access their PC at any time.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Windows
iPhone/iPad
Server
Mac
Copy link
Send
Download

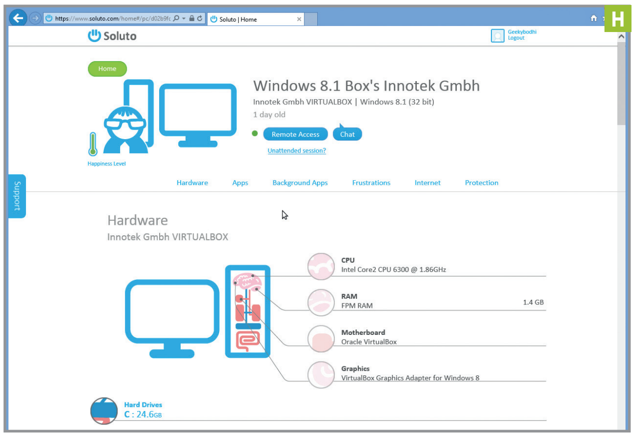
Support a PC

Send a download link

https://www.soluto.com/profile/41612526/a01nc25ei48k

Or, download an installer

Save the installer and run it on a PC you'd like to manage.

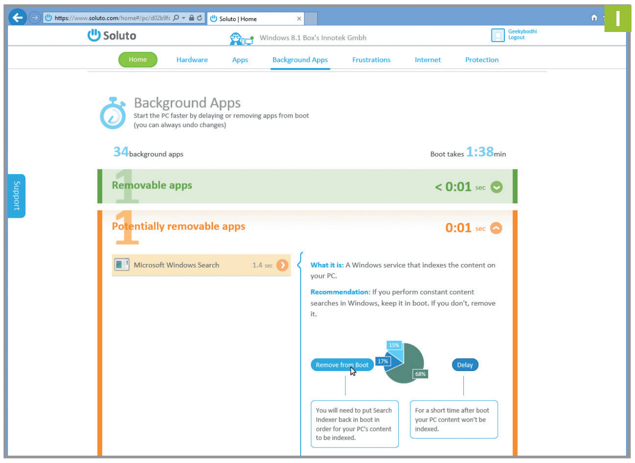

H
Soluto | Home
Soluto
Geekybodhi
Logout
Home
Remote Access
Chat
Unattended session?
Happiness Level
Hardware
Apps
Background Apps
Frustrations
Internet
Protection
Support

https://www.soluto.com/home#/pc/d02b9fc

Windows 8.1 Box's Innotek Gmbh
Innotek Gmbh VIRTUALBOX | Windows 8.1 (32 bit)
1 day old

Hardware
Innotek Gmbh VIRTUALBOX

CPU: Intel Core2 CPU 6300 @ 1.86GHz
RAM: FPM RAM 1.4 GB
Motherboard: Oracle VirtualBox
Graphics: VirtualBox Graphics Adapter for Windows 8
Hard Drives: C : 24.6GB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Frustrations
Internet
Protection
Support
Remove from Boot
Delay
15%
17%
68%

https://www.soluto.com/home#/pc/d02b9fc

Windows 8.1 Box's Innotek Gmbh

Background Apps
Start the PC faster by delaying or removing apps from boot
(you can always undo changes)

34 background apps — Boot takes 1:38 min

1 Removable apps < 0:01 sec

1 Potentially removable apps 0:01 sec

Microsoft Windows Search 1.4 sec

What it is: A Windows service that indexes the content on your PC.

Recommendation: If you perform constant content searches in Windows, keep it in boot. If you don't, remove it.

You will need to put Search Indexer back in boot in order for your PC's content to be indexed.

For a short time after boot your PC content won't be indexed.

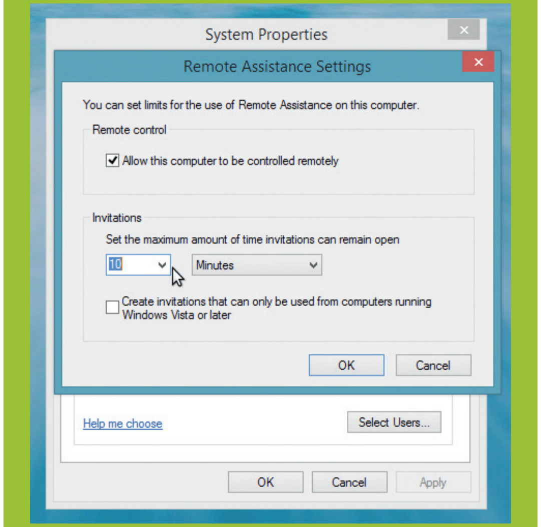
A WORD ABOUT SAFETY

Making it easy to allow others to gain access to your computer remotely might seem like a very bad idea from a security point of view. After all, what's to stop them from going through your files?

Don't fret. Microsoft has built in several mechanisms to protect you. First of all, the Remote Assistance tool allows only remote connections that you invite. Secondly, you can configure the tool so that it sends only invitations that expire if they are not used within a set time limit, such as 10 minutes.

Also, unless you explicitly allow the remote user to manipulate your computer, they can only view your screen. Even then, you can still see what they are doing with your PC in real time, and can close the connection as soon as you get a whiff of something fishy.

A Remote Desktop Connection is more forgiving and should therefore be used only to give access to people with whom you can trust your data.


System Properties
Remote Assistance Settings
OK
Cancel
Help me choose
Select Users...
OK
Cancel
Apply

You can set limits for the use of Remote Assistance on this computer.

Remote control
☑ Allow this computer to be controlled remotely

Invitations
Set the maximum amount of time invitations can remain open
10 Minutes
☐ Create invitations that can only be used from computers running Windows Vista or later

Reduce Your PC's Power Usage

YOU'LL NEED THIS

WINDOWS
Any version of Windows from the last decade will have the features used in this article.

Utility bills are always on the rise, and we're all becoming more aware of the power used by our devices in and around the home. Indeed, many utility providers now give away monitors that enable you to see just how much power is being used at any one time. Getting your computer to reduce the amount of juice it's drawing, while not affecting the way you use it, is not only good news for your fuel bills, it can also reduce your carbon footprint, too.

Thankfully, there's plenty you can do with your computer to make sure that it's only using the power it needs to function. In this tutorial, we're going to take you through the various power profiles within the Windows operating system that enable you to tailor the power requirements of your machine—without having a negative impact on its overall responsiveness.

1

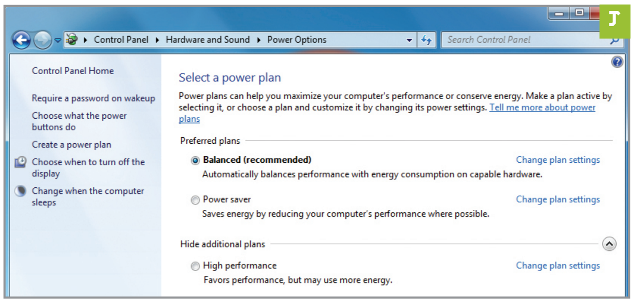
TWEAK YOUR POWER PROFILE Windows boasts three separate power profiles that can help you get more from your home machine. These are defined as Balanced, High Performance, and Power Save. To access these profiles, you need to enter the Power Profile Manager by selecting "Start > Control Panel > Hardware and Sound," then click the "Power Options" section.

» By default, the Balanced (and most recommended) profile is in place (**Image J**), marrying performance with energy consumption. Power Saver improves your machine's power consumption by being a little more aggressive with powering down and idling. The High Performance option ignores power saving and allows for the top performance possible from your PC.

» These defaults are good starting points, but if you want real control over your power usage, you're better off creating your own power profile. Click "Create a power plan" in the left-hand panel, select "Power saver" as your starting point, and name it "Super Power Saver" before clicking "Next."

» On the next screen you can define how long the machine should wait before moving into sleep mode. We recommend setting the "Turn off the display" option to 1 minute, and the "Put the computer to sleep" setting to 5 minutes. When you're done, click the "Create" button.

» Hibernate is a special power saving mode that turns off the power to your PC almost completely. You can configure your machine so that it uses this mode instead of going to sleep for better power-saving results. Select "Choose what the power buttons do" and set the "When I press the sleep button" action to "Hibernate" (**Image K**).


J
Control Panel ▸ Hardware and Sound ▸ Power Options
Search Control Panel
Control Panel Home
Require a password on wakeup
Choose what the power buttons do
Create a power plan
Choose when to turn off the display
Change when the computer sleeps
Change plan settings
Change plan settings
Change plan settings

Select a power plan

Power plans can help you maximize your computer's performance or conserve energy. Make a plan active by selecting it, or choose a plan and customize it by changing its power settings. Tell me more about power plans

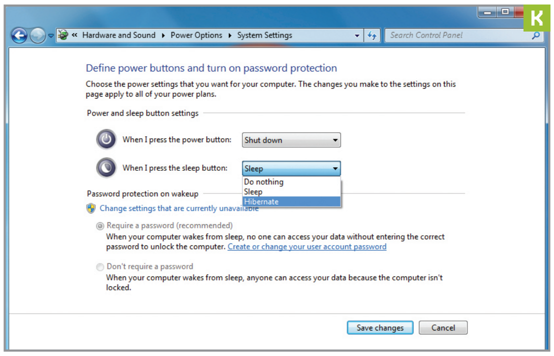
Preferred plans

● Balanced (recommended)
Automatically balances performance with energy consumption on capable hardware.

○ Power saver
Saves energy by reducing your computer's performance where possible.

Hide additional plans

○ High performance
Favors performance, but may use more energy.


K
« Hardware and Sound ▸ Power Options ▸ System Settings
Search Control Panel
Do nothing
Sleep
Hibernate
Change settings that are currently unavailable
Create or change your user account password
Save changes
Cancel

Define power buttons and turn on password protection

Choose the power settings that you want for your computer. The changes you make to the settings on this page apply to all of your power plans.

Power and sleep button settings

When I press the power button: Shut down

When I press the sleep button: Sleep

Password protection on wakeup

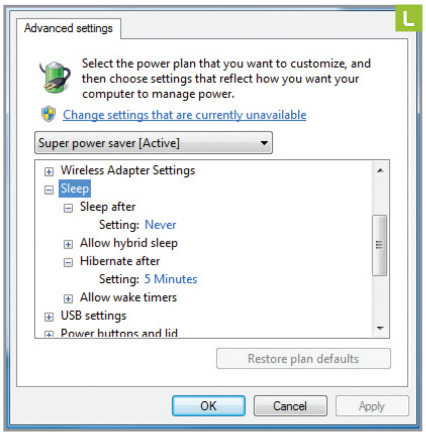
● Require a password (recommended)
When your computer wakes from sleep, no one can access your data without entering the correct password to unlock the computer.

○ Don't require a password
When your computer wakes from sleep, anyone can access your data because the computer isn't locked.

2

ADVANCED OPTIONS Now to pull out all the stops. Click "Change plan settings" to the right of your Super Power Saver profile and then select the "Change Advanced power settings" option at the bottom of the screen. Expand the "Hard disk" entry and set the drive to turn off after 10 minutes or so. Next, expand the "Sleep" option, delete the number of minutes in the "Sleep after" option, and set "Hibernate after" to 5 minutes (**Image L**). Click the OK button.

» If you're using a laptop, you can define what happens when you close the lid, too. Click "What happens when I close the lid" to the left of the window. You'll find two options here, battery or plugged into a power socket. Click the "On battery" option and set it to "Hibernate," and leave "Plugged in on sleep" enabled. ⏻


L
Advanced settings
Change settings that are currently unavailable
Restore plan defaults
OK
Cancel
Apply

Select the power plan that you want to customize, and then choose settings that reflect how you want your computer to manage power.

Super power saver [Active]

- ⊞ Wireless Adapter Settings
- ⊟ Sleep
  - ⊟ Sleep after
    - Setting: Never
  - ⊞ Allow hybrid sleep
  - ⊟ Hibernate after
    - Setting: 5 Minutes
  - ⊞ Allow wake timers
- ⊞ USB settings
- ⊞ Power buttons and lid

BUILD IT

TOM MCNAMARA **ASSOCIATE EDITOR**

DIY Micro-Tower with Liquid Cooling

Most people would never build their own small form factor PC, fill it with high-end hardware, liquid-cool it, then overclock it. Luckily, we're not most people

LENGTH OF TIME: **2–4 HOURS** | LEVEL OF DIFFICULTY: **HARD**

THE MISSION The interest in small form factor (SFF) computing seems to have reached a fever pitch over the past few months, but boutique system builders tell us they've been selling an S-load of them for some time now. The reason for their popularity is not hard to understand—they pack all the firepower of a full-sized ATX machine but take up half the space due to clever engineering. It takes equally clever building to fit a full-sized video card, an internal power supply, storage devices, and even liquid cooling into such a tiny box. That's no small feat, and to be honest, it sounded like just the kind of challenge that we wanted to take on for Build It. The problem is, the micro-tower form factor hasn't been around very long, so it still has some kinks to work out. We've worked with several of these systems over the past few months, and the degree of usability varies quite a bit. However, Silverstone recently announced the Raven RVZ01, a case that seems to have the ease-of-use that we like; plus, the company has demo'd the chassis using a liquid-cooling system, which we found downright nifty. All we had to do was get our hands on one and go to work.

BIRDS OF A FEATHER

TO CONSTRUCT a PC inside a mini-tower like the Raven, you really have to be prepared to build in a completely different way than you have before, and using some atypical parts, too. For example, in this case (which is a preproduction model, so retail units might differ slightly) the optical drive bay only holds a "slim" design, as its front bezel is less than half the size of a standard 5.25-inch drive. The power supply is also not standard ATX: a Silverstone ST45SF-G from the company's SFF SFX line of PSUs designed for tiny rigs like this. It can't supply as much juice as a full-size ATX power supply because it's so small, but it's still able to throw down 450 watts. Surprisingly, this is actually enough wattage for a system with a single video card and a relatively efficient Intel Haswell CPU.

When we say "single card," we mean any single-GPU card you can find, as there's more than enough room for even super-long boards. We stuffed an Nvidia GeForce GTX 780 Ti into our box and had plenty of room left over. (We could have fit a dual-GPU card, but the power supply wouldn't be able to handle that.) There's also enough room for a 3.5-inch hard drive in the RVZ01, in addition to two 2.5-inch drives, but we ended up sacrificing our 3.5-inch drive to the liquid-cooling gods. Since we were using an expensive CPU cooler, we figured we might as well go top-shelf all around, so we went with Intel's Core i7-4770K CPU and the Maximum VI Impact motherboard from Asus.

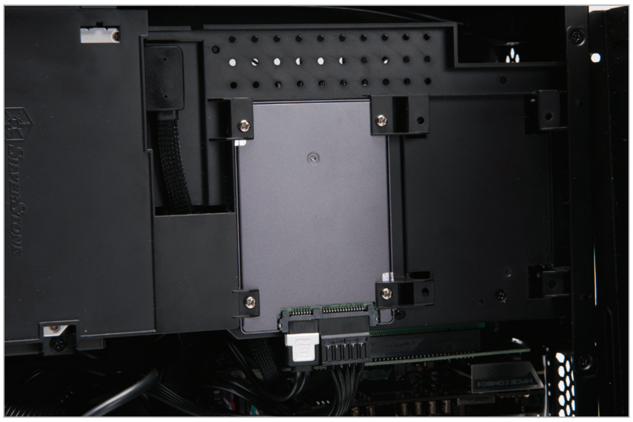
INGREDIENTS

	PART	PRICE
Case	Silverstone Raven RVZ01	**$100**
PSU	Silverstone ST45SF-G 450W	**$100**
Mobo	Asus Maximus VI Impact	**$230**
CPU	Intel Core i7-4770K	**$325**
Cooler	Corsair Hydro H75	**$85**
GPU	Nvidia GeForce GTX 780 Ti	**$700**
RAM	2x 8GB Corsair Vengeance LP	**$160**
SSD	Corsair Neutron GTX 480GB	**$400**
Optical Drive	Silverstone SOD02 8x DVD Burner	**$70**
Cables	Silverstone PP05-E Flat Power Cable Kit	**$25**
OS	Windows 8.1 64-bit OEM	**$100**
TOTAL		**$2,295**

1

PREY DRIVE

SINCE THIS BUILD IT is more of an experiment than a full-fledged gaming or productivity system, we felt comfortable sticking to just one solid-state drive (SSD) for our storage needs. One of the main benefits of using just an SSD in a small system like this is that it cuts down on the cabling we'd need to wrestle with later, which can take up a surprising amount of space. An SSD is also much smaller than a desktop mechanical drive and makes no noise since it has no moving parts. In the RVZ01, SSDs are mounted on a detachable section that also holds the video card and the optical drive. This design makes the SSD quite easy to access, and adding a second drive is easy, too.



2

MOTHER-BIRDS

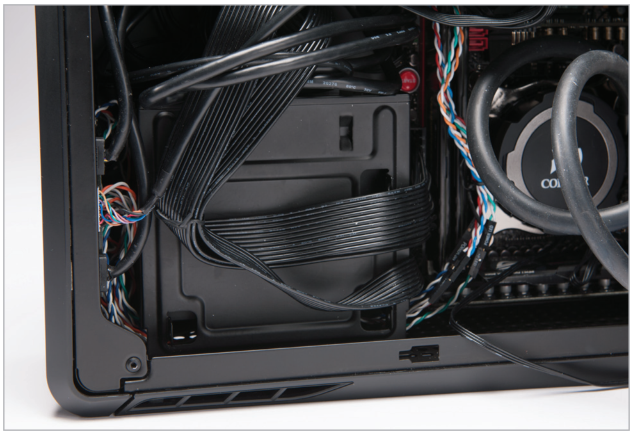
THE RVZ01 FEATURES an "inverted" design, so we had to flip the Asus Maximus VI Impact motherboard upside down and rotate it 180 degrees, which is why the connectors in the photo look backward. The case's side panel that's behind the motherboard tray is permanently attached, so we had to install the liquid cooler's backplate before we installed the motherboard. This motherboard also has a riser card that needs to be installed if you want to take advantage of the mobo's integrated sound. There's another optional add-in card that offers Wi-Fi and Bluetooth, which contains yet another connector, this time for M.2—the successor to mSATA, which is designed for ultrabooks and other systems too small to fit an SSD. And there's a third pre-installed riser at the bottom of the board containing extra capacitors for overclocking. We removed the riser's two screws, because those holes double as motherboard mounting points. Then we put the I/O shield in the case, followed by the board.

REPUBLIC OF GAMERS

3

BIRD ON A WIRE

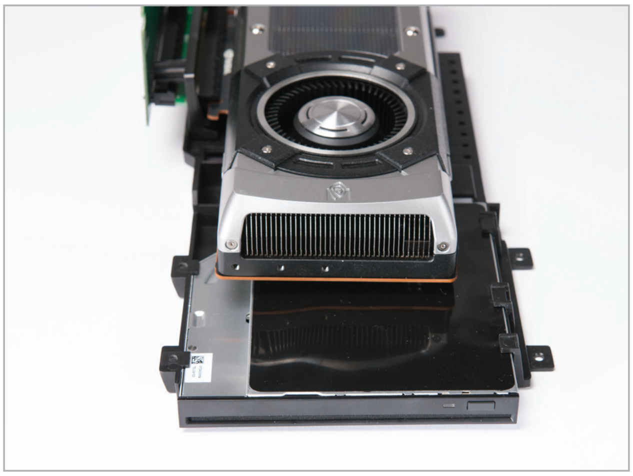
INSIDE THIS BLACK cage is the junior-sized Silverstone power supply. The cage is attached to the case with four standard screws. Take those out, slide the PSU in with its connectors facing up and its intake fan facing toward the fan grill on the side panel, secure it to the bottom of the cage with the four provided screws, and put the whole thing back in. We routed most of the front-panel wiring underneath the cage, to leave more room up top for other wires. The short flat cables come from Silverstone's PP05-E flat power cable kit, which is sold separately from the PSU. They are highly flexible and a godsend in tight quarters like these.



4

EAGLE EYES

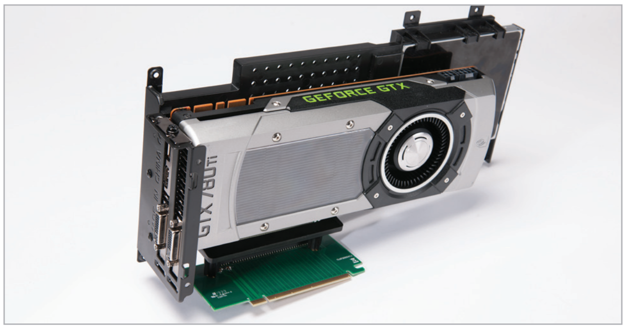
THIS REMOVABLE LEDGE contains the optical drive and a platform for the GPU. As you can see, only a "slim" style of optical drive will fit, and luckily, Silverstone has one named the SOD02, which is an 8x DVD burner. Sure, it's not a BD-R drive and it's not cheap, but if you need an optical drive in this case, you don't have a ton of options. To install it you have to remove the top half of the case's interior by removing six Phillips screws around the rim, and the drive slides into the front. The mounting holes for the optical drive were too small for the heads of the screws that come with the drive, so we couldn't put them in. You need to use the screws that come with the case, instead. The drive was surprisingly snug without the screws anyway, so we just left it "loose" in the slot.



5

SPREADING OUR WINGS

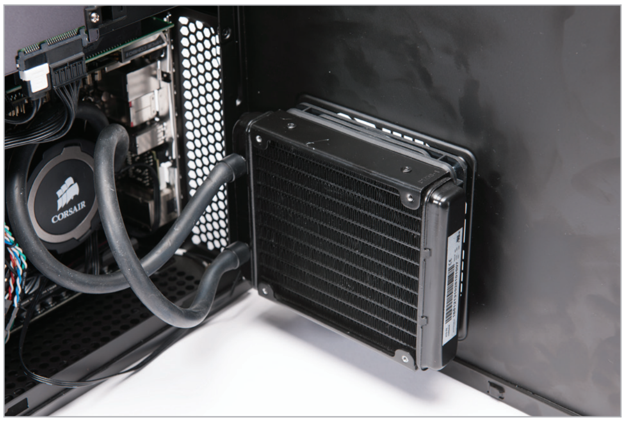
THE DETACHABLE section is also where we installed the Nvidia GeForce GTX 780 Ti. We could shave about $450 off this build and go with a more moderately tuned GPU like a GTX 760, but we wanted to see if both the case and PSU could handle a full-powered and full-sized GPU. We chose the GTX 780 Ti because it's currently the fastest single-GPU available, and produces a decent amount of heat, too. To install it, we had to first plug the GPU into a PCI Express riser card, then attach the PCIe power cables to the card before putting this entire section back into the case; the connectors on the card become inaccessible once it's installed. To make the cabling nice and neat (again, we used those flexible flat cables) we strung them behind the card and curled the cable over the top and into the connectors. Once everything was connected, we plugged the whole contraption back into the case, with the riser pictured below going right into the motherboard's x16 PCIe slot.

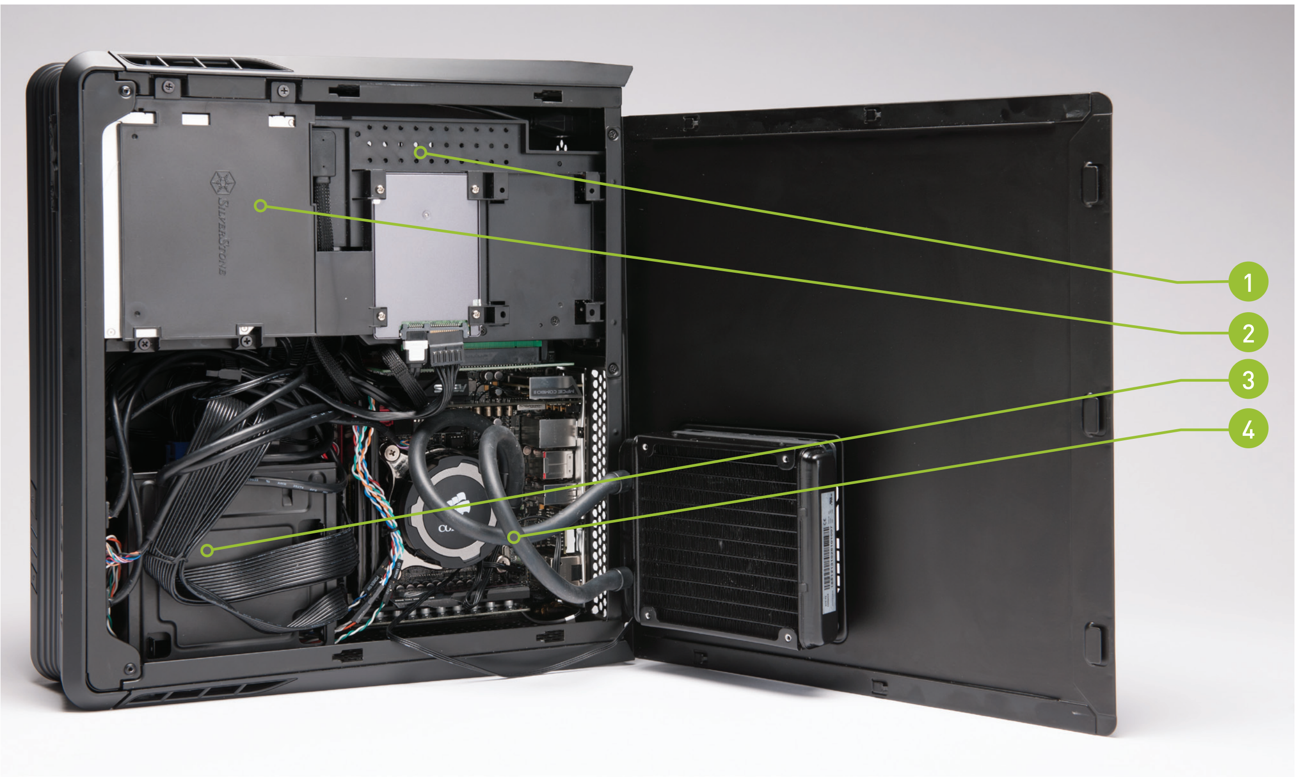


6

SURVIVAL OF THE FITTEST

CPU COOLING duties were handled by a Corsair H75 unit, but to get it to fit we had to swap out the standard 120mm fan, which was too chunky. Instead, we used the slim fan that was pre-installed on the side panel. Although this fan allows us to install the radiator on this super-slim case and still get the door to close, the size of the fan blades mean it won't be able to move as much air as a larger fan. Also, since the fan is thinner we had to use shorter #6-32 3/4-inch machine screws that we bought at a local hardware store to attach it to the radiator. The H75 is a good choice for a small form factor case like this one because of its flexible and relatively narrow tubes. We looped the tubes toward the front of the case, then back, to keep them out of the way of the radiator. We experimented with intake vs. exhaust and push vs. pull; in the end , we went with push exhaust (though pull exhaust is shown in the photos).





1. The detachable section holding the video card gets its own 120mm slim intake fan, with room for a second one; video cards will not be starved for air.

2. The optical drive comes with a right-angle cable combining power and data; it's perfectly suited for the case's snug dimensions.

3. The PSU gets a small intake grill on the other side of the case; it exhausts heat into the case, however, which can complicate overclocking.

4. For a liquid cooler's tubing to fit in this case, it looks like it has to be no more than 1/4-inch thick and made of rubber for maximum flexibility.

SOMETHING TO CROW ABOUT

FOR A MICRO-TOWER, the RVZ01 has particularly accessible areas for the video card, storage devices, and power supply. We've had buzz-killing frustrations installing those components into smaller enclosures before, so the design of this chassis was definitely to our liking. Unfortunately, the case's smaller dimensions meant that cooling was a challenge. The GTX 780 Ti was getting plenty of air, but we struggled to push the CPU beyond its stock specifications. We first ran it up to 4.2GHz, but in extended testing under load, temps were hovering at 90 C when running the x264 encoding benchmark. That's not good, and too hot for our tastes. We've overclocked with the H75 in a tight space before (February 2014 issue), so we knew the cooler could handle the task. Upon investigation, we realized the case's stock "slim" fan that we attached to the Corsair H75's radiator doesn't have a lot of focused air pressure, so it's not great for cooling a rad. (Silverstone makes some excellent high-pressure fans, but they won't fit here.) There's also no intake fan in this part of the case, and no exhaust fans at all. Because of these issues, we ended up running the CPU at stock clocks, but with the motherboard's "Multi-Core Enhancement" pushing all CPU cores to the same speed when under load. Without MCE or manual tweaking, several cores will run below the chip's "turbo boost" rating of 3.9GHz.

We had much better luck with the video card. Despite the GTX 780 Ti having a stock cooler, we were able to overclock the core by 100MHz and the memory by 400MHz (effective), thanks in part to the 120mm intake fan right next to the card. At 4K/UHD, we sustained over 80 FPS in Batman Arkham City, with just PhysX and anti-aliasing disabled. A more demanding game like Hitman Absolution was in the mid-40s, and Tomb Raider (2013) was in the low 30s. That's still very respectable for a single GPU with a stock cooler. Our seemingly "underpowered" 450-watt power supply chugged right along and was totally stable. We plugged in a power meter and discovered that the system didn't draw over 350 watts during the gaming benchmarks, which would be the heaviest real-world usage.

This build was an experiment from the start, so a lack of CPU overclocking was more a learning experience than a shortfall. There's only so much space in a micro-tower to get fancy with CPU cooling. You're probably better off with a "cube" micro-tower for that.

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS6 (sec)	2,000	2,544 (-21.2%)
Stitch.Efx 2.0 (sec)	831	829
ProShow Producer 5.0 (sec)	1,446	1415
x264 HD 5.0 (fps)	21.1	17 (-19.5%)
Batman: Arkham City (fps)	76	78
3DMark11 Extreme	5,847	5,393 (-7.7%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

The zero-point machine compared here consists of a 3.2GHz Core i7-3930K and 16GB of Corsair DDR3/1600 on an Asus P9X79 Deluxe motherboard. It has a GeForce GTX 690, a Corsair Neutron GTX SSD, and 64-bit Windows 7 Professional.

REVIEWS

TESTED. REVIEWED. VERDICTIZED.

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CORSAIR
LG
M-DISC

XIDAX M6 MINING RIG
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The Xidax M6 Mining Rig comes set up with everything you need to start mining crypto-currancy almost right out of the box.

Xidax M6 Mining Rig

A gaming rig that pays for itself

EXOTIC CAR PAINT, multiple GPUs, and custom-built chassis' be damned, boutique PC builder Xidax thinks it has the sexiest sales pitch on the planet with its M6 Mining Rig: It pays for itself! Now, we can't say this PC is basically "free" because it ain't that, but Xidax says by using the box's spare GPU cycles to mine for crypto-currency, this baby would be paid off in about four months. To be honest, it's not something we've ever considered, as we've seen gaming rigs, and we've seen coining rigs, but never in the same box. It seems like a solid idea though, as the system can game during the day, then mine at night to help cover its cost.

The system's specs include a 3.4GHz Core i5-4670K with 16GB of RAM, a Corsair RM 850 PSU, closed-loop liquid cooler, 250GB Samsung 840 EVO SSD, 1TB WD Black, and a pair of Sapphire Radeon R9 290X cards. In application performance, it's pretty pedestrian with its stock-clocked Core i5-4670K. Why not something more badass? Xidax says it weighed hardware choices carefully because the pricier the hardware, the longer it takes to pay off with crypto-coins. The Radeons are a wise choice, as they offer about twice the performance of Nvidia's fastest GPUs in mining applications. Gaming is also quite excellent (obviously, for a two-card system), and its mining performance is impressive at 1.7 to 1.8 Kilohashes per second. (Hashes of the kilo/mega/giga variety are the units of measurement for mining productivity.)

Xidax ships the PC ready to start mining operations almost right out of the box, which is normally a daunting task. It also includes a Concierge (or should we say *coin*cierge) service that has a Xidax rep remotely connect to the rig and do a final tune on the box for maximum mining performance. On this particular machine, it came ready to mine for Doge Coins and was forecast to make about $21.60 a day, or $670 a month, on a 24/7 schedule—including electricity costs.

What's the catch? There are a few. First, it's loud when mining. In fact, it's so loud that you won't be able to stand being in the same room with it. Second, you can't do anything with it while it's mining because all GPU resources are pegged to the max. Third, crypto-currency can be volatile. Bitcoin saw its value see-saw from $130 to $1,242 and then back to $455 and $900 in just four months. It could all go kaput in a few months, or who knows—the government might even step in and ruin the fun.

Considering its performance outside of mining, the M6 Mining Rig is pricey at $3,000. However, the price includes a *lifetime* warranty on parts and service except for the GPUs. Those carry a five-year warranty, which is still surprisingly good, considering that board vendors are already making noises that they don't want to eat the cost of dead boards killed by mining. Xidax says it will cover them, though. And—again—it pays for itself, right?

That's ultimately the appeal of the M6 Gaming Rig, but it has to be carefully considered by potential buyers. After all, anything that sounds too good to be true usually is, but then again, it is a powerful gaming PC that could theoretically pay for itself in a few months. And even if the market blew up, at least you'd still have a formidable gaming PC rather than just standing there with your RAM sticks in one hand. And if it works out, whoa baby, you just got a PC for free! **–GORDON MAH UNG**

VERDICT 8

Xidax M6 Mining Rig

+ **XYLITOL** Concierge service; excellent warranty.

− **XENU** Loud; subject to volatile currency markets.

$3,000, www.xidax.com

BENCHMARKS

	ZERO-POINT	
Premiere Pro CS6 (sec)	2,000	3,092 (-35%)
Stitch.Efx 2.0 (sec)	831	927 (-10%)
ProShow Producer 5.0 (sec)	1,446	1,432
x264 HD 5.0 (fps)	21.1	14.6 (-31%)
Batman: Arkham City (fps)	76	85
3DMark 11	5,847	8,020

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a hexa-core 3.2GHz Core i7-3930K 3.8GHz, 8GB of Corsair DDR3/1600, on an Asus Sabertooth X79 motherboard. We are running a GeForce GTX 690, an OCZ Vertex 3 SSD, and 64-bit Windows 7 Professional.

SPECIFICATIONS

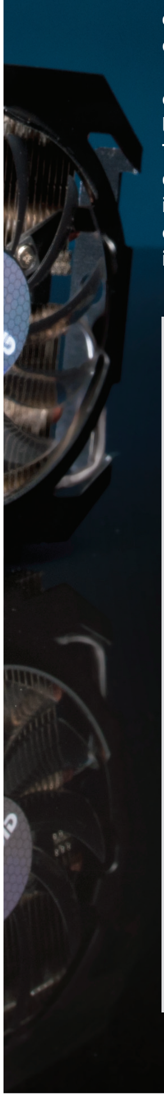
Processor	3.4GHz Core i5-4670K
Mobo	MSI Z87-G45
RAM	Corsair 16GB DDR3/1600
Graphics	2x Sapphire Radeon R9 290X in CrossFire
Storage	250GB Samsung 840 EVO, 1TB WD Black
Optical	LG Blu-ray Combo Drive
Case/PSU	Corsair Air 540 / Corsair RM850

Unlike the reference design, Gigabyte's R9 290X is cool, quiet, and overclockable.

WINDFORCE
GIGABYTE
GIGABYTE
GIGABYTE
GV-R929XOC-4GD REV:1.0

Gigabyte Radeon R9 290X OC

As good as it gets, if you can find one to buy



AFTERMARKET Radeon R9 290X GPUs are beginning to make the rounds, and this month we had a WindForce-cooled behemoth from Gigabyte strutting its stuff in the lab. Unlike last month's Sapphire Tri-X R9 290X, this board features a custom PCB in addition to the custom cooler, whereas the Sapphire slapped a huge cooler onto the reference design circuit board. Theoretically, this could allow for higher overclocks on the Gigabyte due to better-quality components, but more on that later.

This is the overclocked version of the card, so it clocks up to 1,040MHz under load, which is a mere 40MHz over stock. These boards always have conservative overclocks out of the box, though, and that is by no means the final clock speed for this card. We've covered its WindForce cooler in past reviews, so we won't go into all the details, but it's a three-fan cooler that only takes up two PCIe slots and uses six heat pipes with inclined heatsinks to better dissipate the warm. It's good for 450W of heat dispersal, according to Gigabyte, and since the R9 290X is roughly a 300W card (AMD has never given a TDP for this particular model for some reason), the WindForce cooler should be more than up to the job.

Like all Radeon R9 290X boards, this sucker is big and long, measuring 11.5 inches. Gigabyte recommends you use at least a 600W power supply with it, and it sports two dual-link DVI ports for 2560x1600 gaming, as well as HDMI 1.4 and DisplayPort 1.2a if you want to run 4K. The card comes bundled with a free set of headphones. It used to include a free copy of Battlefield 4, but the company told us it was no longer offering the game bundle because it had run out of coupons. The MSRP of the board is $620, but some stores had it for $599 while others marked it up to $700.

Once we had this Windy Bad Boy in the lab, we were very curious to compare it to the Sapphire Tri-X R9 290X we tested last month. Since both cards feature enormous aftermarket coolers, have the exact same specs and clocks, and are roughly the same price, we weren't surprised to find that they performed identically for the most part.

If you look at the benchmark chart, in every test the two cards are almost exactly the same—the only exception being Metro, but since that's a PhysX game, AMD cards can get a bit wonky sometimes. In every other test, the two cards are within a few frames-per-second difference, making them interchangeable. Both cards also run in the mid–70 C zone under load, which is 20 C cooler than the reference design. We were able to overclock both cards to just a smidge over 1,100MHz, as well.

"Okay," you are saying to yourself. "I'm ready to buy!" Well, that's where we run into a small problem. Gigabyte's MSRP for this card is $620—the same as the Sapphire Tri-X card—but at press time, the cheapest we could find it for was $700 on Newegg. We can't ding Gigabyte for Newegg's pricing, but it's a real shame these R9 290X cards are so damned expensive.

–JOSH NOREM

BENCHMARKS

	Gigabyte Radeon R9 290X OC	Sapphire Tri-X Radeon R9 290X	AMD Radeon R9 290X Reference	Gigabyte GeForce GTX 780 GHz
Driver	13.12	13.12	13.12	331.82
3DMark Fire Strike	**9,837**	9,820	9,737	9,695
Unigine Heaven 4.0 (fps)	34	33	32	**39**
Unigine Valley 1.0 (fps)	41	40	36	**47**
Call of Duty: Ghosts (fps)	48	44	47	**53**
Crysis 3 (fps)	**32**	30	28	30
Far Cry 3 (fps)	38	39	31	**44**
Tomb Raider (fps)	26	26	**27**	25
Metro: Last Light (fps)	18	**26**	17	25
Battlefield 4 (fps)	46	46	45	**47**
Assassin's Creed: Black Flag (fps)	30	30	30	30

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus Rampage IV Extreme motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 8. All games are run at 2560x1600 with 4X AA except for the 3DMark tests.

VERDICT
9
KICK ASS!

Gigabyte Radeon R9 290X OC

⊞ **SWEET** Cool; quiet; fast; overclockable.

⊟ **RAD** Expensive; hard to find.

$620, www.gigabyte.us

The E93z's 21.5-inch monitor is small compared to other recent AIOs.

Lenovo ThinkCentre E93z

Good power, average everything else

THE MAJORITY of our work computers are boring metal boxes, but Lenovo hopes to class up the joint with its ThinkCentre E93z all-in-one PC. Designed for small to medium-sized businesses, Lenovo's AIO aims to deliver competent computing firepower in a more attractive package.

Starting off, the glossy 1920x1080 21.5-inch 10-point touchscreen monitor is a bit smaller than we would like, considering most other modern AIOs are more in the 23–27-inch range. This, in addition to the large bezel, makes it look dated.

The panel is a TN that, not surprisingly, looks dim at extreme viewing angles. The E93z also comes with a 2MP webcam located above the monitor, which isn't out of the ordinary, although the more paranoid among us will be glad there's a physical slider to block the NSA's prying eyes.

On the left side of the unit are two USB 3.0 ports, an SD card reader, and a single combination audio and mic input. Behind the panel, the AIO has four USB 2.0 ports, Ethernet port, and separate in/out HDMI ports. Finally, the DVD burner, volume rocker, HDMI input switch, and power button can all be found on the right side of the unit.

In addition to offering a decent array of ports, the E93z packs some firepower in the CPU department. Our configuration came with an Intel Core i7-4770S, which carries a base clock of 3.1GHz and can turbo up to 3.9GHz. And while the E93z is billed as a work PC, we aren't stuck with integrated graphics. Instead, it has a new GeForce 720A GPU. Unfortunately, the AIO skimped out in two areas: a mere 4GB of RAM in a single-channel package and a paltry 500GB of storage. To its credit, it is a hybrid drive and you can opt for a 1TB hard drive, but it would still be nice to have the option of going with both an SSD and a beefier HDD. It should also be noted that you can similarly opt to up the RAM to 16GB, but considering our configuration's $1,300 price tag, we think it should have at least 8GB.

Regardless of the limited RAM, the E93z killed it in our CPU tests. It made our Asus ET2300 zero-point's Ivy Bridge 3GHz Core i5-3330 seem ancient, leaving our system in the dust by 8–12 percent in the single-threaded tests and obliterating it by 52 percent in the multithread-heavy X264 HD 5.01 benchmark. Ouch. Both are quad-cores, but you can thank the Hyper-Threading and improved Haswell cores for the performance in the Lenovo.

Things weren't as definitive in the graphics benchmarks, however. Both GPUs are similar in class with the Lenovo's 720A having zippier memory and boost clocks, while the Asus's 630M has a slightly faster GPU clock and double the memory bus width. When it came down to brass tracks, the AIOs traded blows. Lenovo's offering enjoyed a 7 percent lead in 3DMark 11, but lost by 15 percent in our Metro 2033 benchmark. Either way, this AIO isn't replacing your gaming rig.

All of this hardware sits atop a circular-based stand that provides the monitor a 70 degree range of tilt, giving it the versatility to be used both while sitting and standing. The stand also has a small ring for routing the power and USB cables, which we appreciated. Many stands allow you to save desktop space by holding the keyboard and mouse, but because of the Lenovo stand's circular design, setting the keyboard on top to stow it makes it pretty wobbly; most other AIO stands accommodate the keyboard and mouse by using a rectangular design.

Speaking of the keyboard, both it and the mouse are wireless. Although the full-size keyboard is comfortable, with retractable feet for those who prefer typing at more of an angle, we wish it had LED indicators for the caps lock button and other toggles. The 400-DPI mouse also gets the job done, though you'll most likely want to tweak the sensitivity. We liked that its middle scroll button allows you to scroll horizontally as well as vertically.

The touchscreen was responsive but fairly standard; it didn't live up to its "lag-less" billing, although the lag was minimal. We were surprised that the AIO's two three-watt speakers offered ample volume but did not like their positioning on the back of the unit; it feels like sound is moving away from you instead of toward you.

Lenovo's E93z offers great CPU performance but is mediocre to average everywhere else. The AIO's relatively small TN panel, scant 4GB of RAM, and very limited storage options prevent us from recommending it. –**JIMMY THANG**

VERDICT

7

Lenovo ThinkCentre E93z

➕ **ALL-IN-ONE** Awesome CPU performance; good assortment of ports.

➖ **NONE-IN-ONE** Relatively small monitor; TN panel; limited storage; only 4GB of RAM.

$1,329, www.lenovo.com

BENCHMARKS

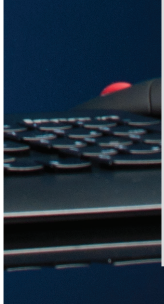
	ZERO-POINT	
Stitch.Efx 2.0 (sec)	1,192	1,103
Proshow Producer 5 (sec)	1,841	1,635
x264 HD 5.0 (fps)	9.9	15.1
Metro 2033 (fps)	22	18.6 (-15.5%)
3DMark 11 Perf	1,333	1,428

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point all-in-one PC is an Asus ET2300 with a 3GHz Intel Core i5-3330M, 8GB DDR3/1600, 1TB 7,200rpm hard drive, a GeForce GT 630M, and Windows 8. Metro was tested at 1280x768 with medium settings and tessellation enabled.

SPECIFICATIONS

CPU	Intel 3.1GHz Core i7-4770S
GPU	Nvidia GeForce GT 720A
RAM	4GB DDR3/1600 in single-channel mode
HDD	500GB Hybrid Drive
Optical	DVD burner
Display	21.5-inch LED backlit TN LCD 1920x1080 10-point touchscreen



Don't bother with the R9 270X—the non-X version shown here is just fine.

MSI Radeon R9 270 Gaming OC

No surprises here, just a solid 1080p card

MSI IS OFFERING two flavors of its midrange Radeon R9 270 GPU, formerly known as the Radeon HD 7870 GHz edition. There is a standard model and one with an "X" after its name. The difference between the two is the X model has slightly higher core and boost clocks, but otherwise the two cards are the same and are both based on AMD's Pitcairn GCN core, which is a 28nm part that debuted in 2013.

The card in front of you is the MSI R9 270 Gaming model, which is a stock R9 270 with a mild overclock, hence the word "Gaming" in its moniker. It has an MSRP of $180, while the X version is roughly $20 more, though street prices are higher due to the mining craze and short supply. For those who are prone to guffawing at a card that is merely rebadged and price-dropped, this is par for the course and actually good news for gamers. That's because both Nvidia and AMD refine their manufacturing processes over time, so by the time a GPU gets a rebadge, it's often able to run at higher clocks with better efficiency for a much lower price. The bottom line is that this card once had a $350 price tag and now costs less than $200, so there's very little to complain about.

To rehash the specs, this is a card with a base clock of 900MHz and a boost clock of 975MHz, which is 50MHz higher than the reference board. It has 2GB of GDDR5 memory that runs at 5.6GHz, and 1,280 stream processors. Since this is not new silicon, the card does not offer support for TrueAudio, but as it's a Graphics Core Next (GCN) card, it does support AMD's new Mantle API (at press time, BF4 was not optimized for Mantle with the R9 270, but AMD said it's "being investigated"). As a midrange GPU, the R9 270 has a low-ish TDP of 150w, and therefore requires only a single six-pin PCIe connector for power—an advantage over the 270X, which requires two six-pin connectors. Interestingly, the R9 270 doesn't have a direct competitor from Nvidia since it costs just a bit over $200, so it sits right in between the $250 GTX 760 and the $150 GTX 650 Ti (the Ti Boost is out of stock everywhere, but costs around $175). The GTX 660 is about the same price, but that card is ancient, so we compared it to the more-expensive GTX 760.

Overall, we had a pleasant testing experience with the MSI R9 270 card. It was quiet and cool—never getting hotter than 60 C—and was totally stable. It ran the grueling new Star Swarm demo over a weekend with nary a hiccup, and we were also able to overclock it to 1,140MHz boost clock, which netted a 10 percent bump in performance. Basically, we found its performance exactly in line with its price, in that it was a bit slower than the more-expensive GTX 760 in all the games we test aside from Tomb Raider, which is an AMD game.

In the end, there's nothing wrong with the MSI R9 270 Gaming OC and we have no problem recommending it. However, we'd still go with the GTX 760 just because it is quite a bit faster in many games, and only costs $30 more. If Mantle support is important to you, though, feel free to pull the trigger. **–JOSH NOREM**

BENCHMARKS

	MSI Radeon R9 270 Gaming OC	AMD Radeon R9 270X (reference)	Asus GTX 760
Driver	14.1 Beta	14.1 Beta	320.49
3DMark	5,271	5,601	**5,945**
Unigine Heaven 4.0 (fps)	28	30	**37**
Unigine Valley 1.0 (fps)	37	38	**48**
Crysis 3 (fps)	25	26	**31**
Far Cry 3 (fps)	33	35	**40**
Tomb Raider (fps)	26	**27**	25
Metro: Last Light (fps)	16	16	**25**
Battlefield 4 (fps)	41	42	**45**
Batman: Arkham Origins (fps)	45	53	**62**
CoD: Ghosts (fps)	43	45	**54**

Best scores are bolded. Our test bed is a 3.33GHz Core i7-3960X Extreme Edition in an Asus Rampage IV Extreme motherboard with 16GB of DDR3/1600 and a Thermaltake ToughPower 1,050W PSU. The OS is 64-bit Windows 8. All games are run at 1920x1080 with 4X AA except for the 3DMark tests.

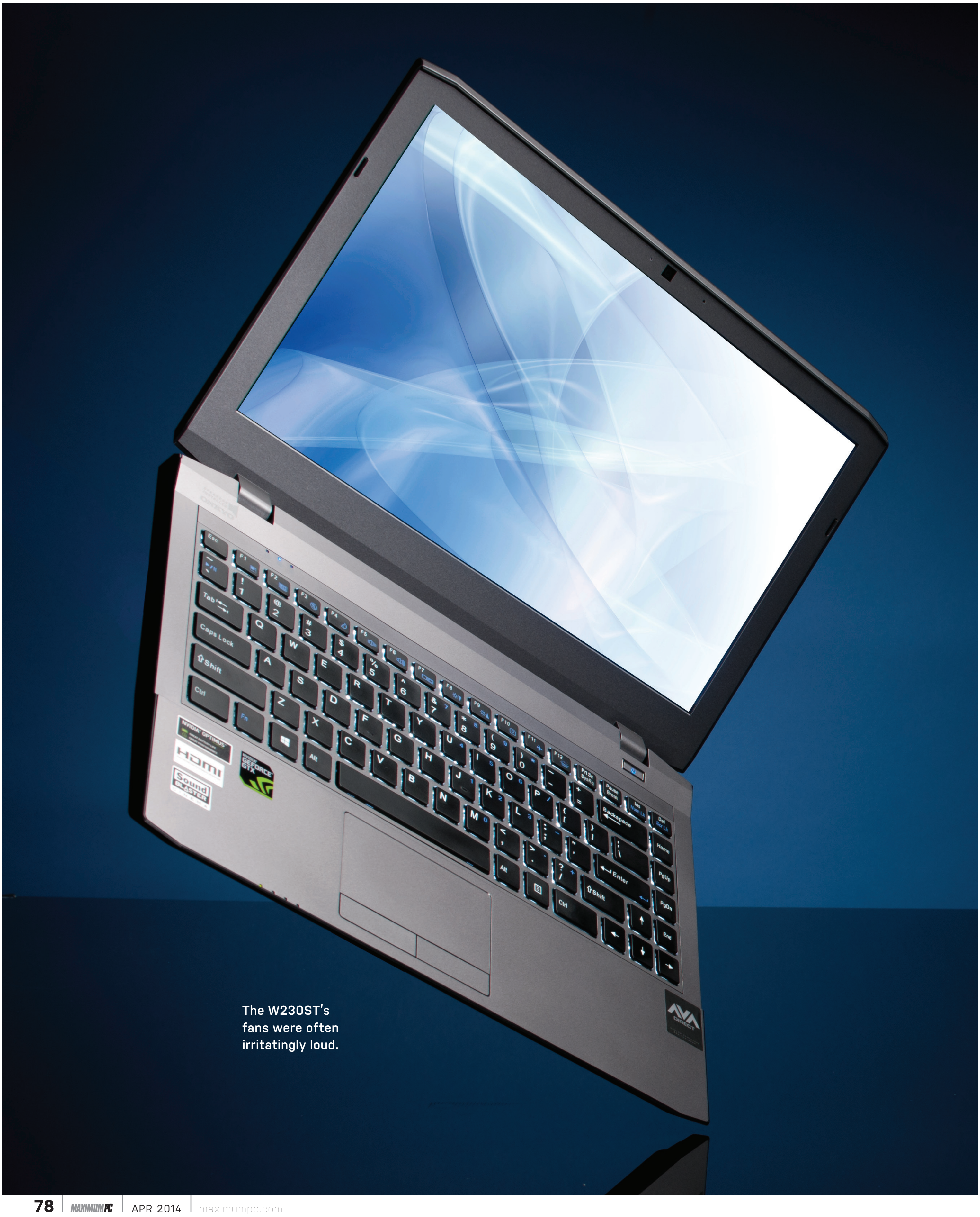
VERDICT 8

MSI Radeon R9 270 Gaming OC

+ GAMING Great 1080p card; quiet and cool; one six-pin PCIe connector.

– MAIMING Barely 30fps in several tests; street cost is higher than MSRP.

$220 (street), www.msi.com



The W230ST's fans were often irritatingly loud.

AVADirect Clevo W230ST

A case of too much power in a too-little chassis

AS MUCH AS WE enjoy pure PC power in our gaming laptops, we hate having to lug around big, hulking notebooks. Thankfully, this is something AVADirect attempts to address with its latest Clevo laptop, the W230ST. Its compact 13.3-inch gaming notebook chassis is crammed with impressive hardware, including a quad-core 2.7GHz Core i7-4800MQ, GeForce GTX 765M, and 16GB of RAM. While it may sound like you're getting the best of both worlds, AVADirect's Clevo ends up biting off more than it can chew.

In terms of portability, AVADirect's offering really does pull through. Using the same 13x9x1.25-inch chassis as Digital Storm's Veloce reviewed in our December issue, it's smaller than most other gaming laptops, save for Razer's 14-inch super-slim Blade notebook. And weighing in at less than five pounds, we had no complaints lugging it around CES with us for an entire week.

Aesthetically, the W230ST is generic. There is a small AVADirect sticker next to the trackpad but no other branding. The lid's black rubberized top contributes to the plainness, but at least gives it some grip when carrying it with one hand.

While we love the notebook for its portability, its performance is mixed despite its specs. The GTX 765M performed quite well and managed from three to nine percent gains over our Alienware 14 zero-point laptop, which uses the same mobile graphics card. When we turned to our CPU-centric tests, though, it turned ugly. The AVADirect saw a 4 to 14 percent deficit against the Alienware, which has a Core i7-4700MQ that's clocked 300MHz lower than the AVADirect's CPU. It took the biggest beating in the multithreaded X264 HD 5.01 run. Even though the Core i7-4800MQ is spec'd to hit a max turbo of 3.7GHz, it'll only sit there on light loads. On loads that push four threads, such as our ProShow Producer test, it mostly hangs tight at 3GHz, where the Alienware will chug along at 3.2GHz. The reason is thermals and the bigger, thicker Alienware can quietly dissipate the heat while the AVADirect clocks down and cranks up the fans. And that brings us to the next issue: noise.

Noise during multi-threaded loads is understandable, but the fans often ran embarrassingly loud even when we were just browsing the web. To make matters worse, the laptop's speakers are quite weak and were often drowned out by the fan. Battery life also let us down, with a disappointing two hours and 45 minutes on video playback. On a gaming notebook it's usually forgivable, but the portability of the AVADirect carries an expectation of good battery life.

Less offensive was its keyboard, which features chiclet keys and white LED backlighting. Its Synaptics trackpad is serviceable and we liked how it had two separate dedicated buttons, though we found two-finger scrolling horribly unresponsive on it. On the bright side, the notebook's IPS screen looks fantastic and offers excellent viewing angles (we wish more vendors would choose the option).

AVADirect's W230ST does have a lot going for it. In addition to its awesome display, the notebook offers impressive GPU performance and is very portable. At $1,557 it's priced fairly, though if you intend to use it just for gaming, we would suggest saving 80 bucks by going for 8GB of RAM instead of the 16GB configured here, as that's still plenty for gaming. At the end of the day, however, with its ho-hum battery life and annoyingly loud fan, we can't confidently recommend the W230ST without the buyer being aware of its drawbacks. –**JIMMY THANG**

VERDICT 7

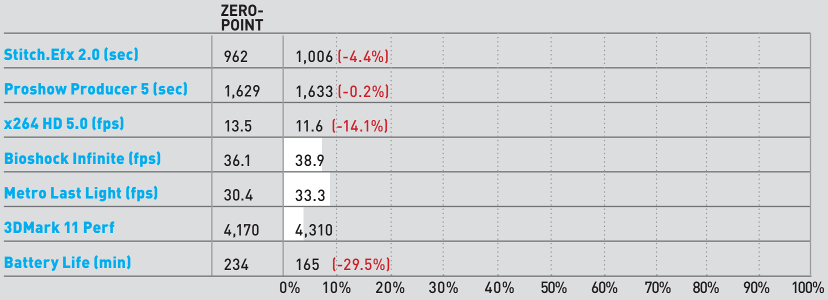
AVADirect Clevo W230ST

+ AVA DIRECT Good graphics performance; very portable; great display.

− AVA PASSIVE AGGRESSIVE CPU performance is underwhelming; annoyingly loud, even at idle.

$1,557, www.avadirect.com

BENCHMARKS



	ZERO-POINT	
Stitch.Efx 2.0 (sec)	962	1,006 (-4.4%)
Proshow Producer 5 (sec)	1,629	1,633 (-0.2%)
x264 HD 5.0 (fps)	13.5	11.6 (-14.1%)
Bioshock Infinite (fps)	36.1	38.9
Metro Last Light (fps)	30.4	33.3
3DMark 11 Perf	4,170	4,310
Battery Life (min)	234	165 (-29.5%)

Our zero point notebook is an Alienware 14 with a 2.4GHz Intel Core i7-4700MQ, 16GB DDR3/1600, 256GB mSATA SSD, 750GB 5,400rpm HDD, a GeForce GTX 765M, and Windows 7 Home Premium 64-bit. BioShock Infinite tested at 1920x1080 at Ultra DX11 settings; Metro Last Light tested at 1920x1080 at DX11 medium quality settings with PhysX disabled.

SPECIFICATIONS

CPU	2.7GHz Intel Core i7-4800MQ
RAM	16GB DDR3/1600
Chipset	Intel HM87
GPU	Nvidia GeForce GTX 765M
Display	13.3-inch, 1920x1080 IPS display
Storage	120GB SSD; 750GB HDD
Optical Drive	N/A
Connectivity	Ethernet, VGA, HDMI, all-in-one card reader, 3x USB 3.0, 1x USB 2.0, headphone, mic, 2MP webcam, Bluetooth, 802.11n
Lap / Carry	4 lbs, 10.6 oz / 5 lbs, 14.6 oz

The H440 is the first case we've tested that doesn't have 5.25-inch drive bays.

NZXT H440

Remarkably clean, and limited, too

WE LOVE THE fact that NZXT bills this semi-silent-themed case as a "hassle-free experience." We wonder if the company was using the same case that we were, because we encountered quite a bit of hassle building a standard configuration into this smaller-than-usual chassis.

For starters, the case itself ships with no printed manual—at least, ours didn't. We only hope that's an oversight with our early review unit instead of a standard feature of the chassis itself, because there are definitely some features of the H440 that warrant a bit of instruction, especially for neophyte builders.

Case in point: There are absolutely zero 5.25-inch bays to be found on the H440, which is a good thing to know before you start attempting to pry off the H440's front (Dremel in hand). We know, we know, the optical drive is dead, long live the optical drive—but is it too soon? To be honest, there's an upstart contingent here at *Maximum PC* who think it's a plus, while some cranky old farts think it's a minus. Additionally, installing the power supply might evoke a bout of head-scratching at first, as there's seemingly no way to just stuff it into the chassis thanks to how it's been compartmentalized on the case's bottom. This does build on the case's motto of "remarkably clean," though, by hiding your messy PSU cabling.

This leads us into one of our major gripes with this chassis: There's a lot of screwing. We pretty much pulled out the thumbscrews in the case's side, which are supposedly designed to not do that. Beyond that, you have to unscrew a panel to slide the power supply in, you have to unscrew the standard PCI slot covers for any devices you want to install, and—most frustratingly—you have to first unscrew the case's steel drive trays (up to six total) just for the privilege of being able to screw in your hard drive. Clean, yes. Toolless, no.

The case feels a bit small on the inside, but it adequately supported our standard test setup (including an Nvidia GTX 480 video card) without any cramming or wedging. We like how the case's three rubberized cable-routing holes fit perfectly with a standard video card setup—when using the top-most PCI Express x16 slot on our ATX motherboard, our video card didn't block any of the much-needed routing holes.

That said, cable routing is a bit of a challenge in the H440. There's already not that much room between the rear of the motherboard tray and the case's side panel. Amplifying the claustrophobia is a layer of soundproofing foam adhered to the side panel. We love that NZXT cares so much about our ears, but it makes for a less-than-pleasant smashing of cables against the case's side (especially since there's only one provided hole for power-supply cables to route through otherwise). Cable-management options feel more constrained by this case than others we've tested.

The foam surrounding the case's insides has quite a bit of work in store for it, too. No fewer than four of NZXT's next-gen case fans grace the inside of the chassis: three 12cm fans on the front and one 14cm fan on the back. When we fired up the system with no components inside it, the soundproof-themed case was a bit audible. A full system only adds to the din, and while we appreciate NZXT's efforts toward keeping the volume dial at a three instead of an eleven, it seems to be a bit of a lost cause.

NZXT seems to think this case is perfect for liquid cooling. For some all-in-one setups, sure; for customized loops, you're going to be in for something of a tubing nightmare. Best of luck! **–DAVID MURPHY**

VERDICT 6

NZXT H440

+ CASE RACE Excellent placement of (limited) cable-routing holes; ample air cooling; lovely looks; USB 3.0 support.

− AMAZING RACE Limited cable-management space; fans overpower soundproofing; too many screws; expensive.

$120, www.nzxt.com

The new Mac Pro stole its design from this router—true story.

D-Link DGL-5500

A router built specifically for gamers

WHEN IT COMES to PC parts and accessories, all roads eventually lead to gamers. Intel and AMD both sell unlocked processors so gamers can more easily overclock their rigs for a few extra frames per second; pro gamer Johnathan "Fatal1ty" Wendel has endorsed everything from motherboards to power supplies; there's gaming RAM; and of course, a whole assortment of accessories designed to give you an edge when smoking your friends on the virtual battlefield. Up until now, one of the few items missing from the list was an 802.11ac wireless router.

D-Link gets credit for tying up that loose end with the DGL-5500, a dual-band AC1300 wireless router built specifically for gamers. What makes the DGL-5500 different from all the other 802.11ac models, including D-Link's own DIR-868L (reviewed in our February issue), is the inclusion of Qualcomm's StreamBoost technology.

Whereas the majority of modern routers rely on simple quality of service (QoS) rules to prioritize network packets, StreamBoost examines what applications are running and how much actual bandwidth each one needs. It also manages latency because a laggy gamer is a dead gamer. The question is, does it work as advertised?

For the most part, StreamBoost lives up to the hype. We consistently saw lower pings in online games when connected to the DGL-5500 versus our zero-point router, the Asus RT-AC66U. External factors beyond our control also affect ping, so it's hard to offer an apples-to-apples comparison, but to give one example, our ping averaged around 42ms in Battlefield 4 when using Asus's router. When switching to D-Link's model and turning on StreamBoost, our pings hovered around 19ms. After firing up Netflix on a second PC and initiating file downloads on two other systems, the ping stayed around 22–24ms—that's impressive.

In our evaluation of D-Link's DIR-868L, we said the fugly web-based interface could use a major overhaul, and that's what we got with the DGL-5500. It's much better looking than before and far less complicated to navigate, though it's also painfully slow when switching between menus. The UI is also heavily biased toward StreamBoost—if you disable the feature, you lose access to the My Network map, which provides a graphical view of all active devices and how much bandwidth each one is consuming.

The DGL-5500 outpaced our zero point router in 802.11n mode on the 2.4GHz band in our three indoor tests. It also did better at picking out uncluttered channels on its own—we use inSSIDer ($20, www.inssider.com) to identify the best channel(s) for testing. However, the RT-AC66U boasts better range and faster transfers in 802.11ac mode on the 5GHz band. It's worth pointing out the DGL-5500 lacks beamforming, which concentrates the wireless signal at connected devices for longer range and better speeds.

There are other shortcomings, as well—you can't configure Guest networks, the single USB 2.0 port doesn't support printer sharing, and the combined speed of both channels is capped at AC1300 rather than AC1750 as it is with D-Link's DIR-868L. While StreamBoost is a step forward, the router is a step backward in other areas. Note to D-Link: Gamers care about this stuff, too. –**PAUL LILLY**

BENCHMARKS

	D-Link DGL-5500 802.11n (2.4GHz)	Asus RT-AC66U 802.11n (2.4GHz)	D-Link DGL-5500 802.11ac (5GHz)	Asus RT-AC66U 802.11ac (5GHz)
Bedroom – 10ft (Mb/s)	**106**	94.3	295	**303**
Dining Room – 15ft, 2 walls (Mb/s)	**104**	94	252	**297**
Entryway – 20ft, 3 walls (Mb/s)	**101**	93	233	**307**
Driveway – 35ft (Mb/s)	59.1	**86.6**	51.6	**182**
Backyard – 90ft (Mb/s)	31.8	**40.2**	19.3	**21.2**

Best scores are bolded. For information on how we test wireless routers, check out http://bit.ly/MPC_Routers2014.

VERDICT
7

D-Link DGL-5500

+ LOW PING Lowers latency when gaming; fast speeds at close range.

− LAGGING OUT No printer sharing; can't configure Guest networks; lacks beamforming.

$140 [street], www.d-link.com

Cooler Master Nepton 280L

Not quite god, but still Herculean

IN THE WORLD of CPUs, closed-loop liquid coolers (CLCs) seem to be standard-issue for enthusiasts these days. They give you higher overclocking headroom than even the most expensive and beefy air coolers, and they can operate more quietly. However, we haven't seen many with radiators as large as 280mm—just the NZXT Kraken X60 and the Corsair H110 come to mind—so we were eager to run the Cooler Master Nepton 280L through its paces.

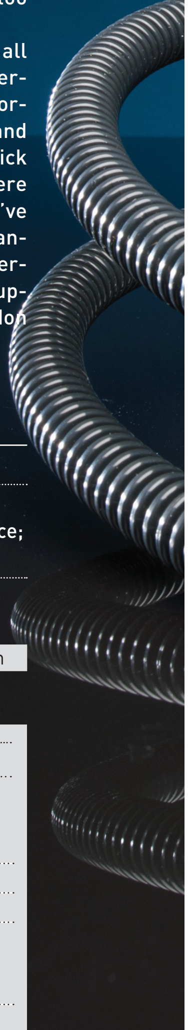
Many hardware vendors have chosen to license their CLC designs from Asetek, whose patents go back quite a way. With the 280L, however, Cooler Master decided to roll its own with a custom pump. It's definitely larger than usual. The tubes coming out of it are sleeved with a material called FEP, which is similar to Teflon and designed to slow the rate of evaporation inside the loop. That's an important factor for a cooler that's not designed to be refilled. Cooler Master is also using its own JetFlo fans, designed for high static pressure. This feature is needed to penetrate into the fins of the radiator, and the 140mm version of the JetFlo is making its debut here (the radiator can also fit 120mm fans).

Pump installation is pretty straightforward. First, we screwed in a small bracket to each side of the cold plate. Then, since our LGA 2011 motherboard has an integrated CPU backplate, we just attached four bundled screws to that, set the cold plate on top the CPU, and added four fasteners to fix the cold plate's brackets to the four screws in the backplate. The fasteners only take a flat-bladed screwdriver, oddly, but they went in smoothly. The radiator screws also come in two sets of eight, differing only a couple of millimeters in length, so it took a minute to separate each type. It would have been better had they been clearly differentiated.

The pump, plugged into our board's secondary CPU fan header, operated at a steady 6,300rpm, which is unusually high. We checked with Cooler Master, and the company agreed. We used a Zalman Fanmate to manually tune it down to 5,000rpm, at which point the pump noise didn't stand out. Despite a loss of 1,300rpm, temps only went up about 1 C during our load test, indicating that the additional speed offered minimal improvement anyway. We then plugged the pump into a chassis fan header without the Fanmate, and it leveled off at 4,500rpm.

Of course, there are caveats. A large percentage of cases will not accommodate a 280mm radiator; either the dimensions are too small or the fan mounts are not sized for it. This is not the radiator's fault, though, so we can't really deduct points for it. It's just something that you have to be aware of. Also, the thick FEP tubes are not especially flexible. The radiator screws have unusually open heads, requiring an uncommonly large bit to avoid stripping. Lastly, the pump is too loud without some fiddling.

These are fairly minor issues that all have workarounds, though. Considering the Nepton's top-tier cooling performance, reasonably low noise levels, and ease of installation, its quirks don't stick out in the end. Its load temperatures were notably lower than anything else we've tested and may allow you to squeeze another couple-hundred MHz out of an overclock. The Nepton is an indisputable upgrade from Cooler Master's older Seidon series. **–TOM MCNAMARA**



VERDICT
9

Cooler Master Nepton 280L

+ WINTER WONDERLAND Excellent thermal performance; smooth installation; rugged design.

− BLACK ICE Moderately noisy pump; somewhat stiff tubing.

$125 (street), www.coolermaster-usa.com

BENCHMARKS

	Nepton 280L Quiet/ Performance Mode	Glacer 240L Quiet / Performance Mode	Kraken X60 Quiet / Performance Mode	Hydro H100i Quiet / Performance Mode
Ambient Air	22.1 / 22.4	22.7 / 23.2	20.9 / 20.7	20.3 / 20.5
Idle Temperature	33.2 / 30	33.7 / 29.5	29.7 / 28.8	30.7 / 29.3
Load Temperature	64.5 / 63.3	67.2 / 62.8	66 / 61.8	67.1 / 61
Load - Ambient	**42.4** / 40.9	44.5 / **39.6**	45.1 / 41.1	46.8 / 40.5
Street Price	$125	$140	$120	$100

Best scores are bolded. All temperatures in degrees Celsius. All tests performed with an Intel Core i7-3960X at 4.1GHz, on an Asus Rampage IV Extreme motherboard, in a Corsair 900D with stock fans set to Standard.

SPECIFICATIONS

Radiator Dimensions (H x D x W)	1.2 x 12.2 x 5.5 inches
Weight	3 lbs, 3 oz
Stock Fans	2x 14cm PWM
Socket Support	LGA 775/1150/1155/1156/ 1366/2011; AM2/ AM2+/ AM3/AM3+/FM1/FM2
Additional Fan Support	2x 12cm or 14cm

COOLER MASTER
COOLER MASTER

The Nepton features a massive 280mm radiator.

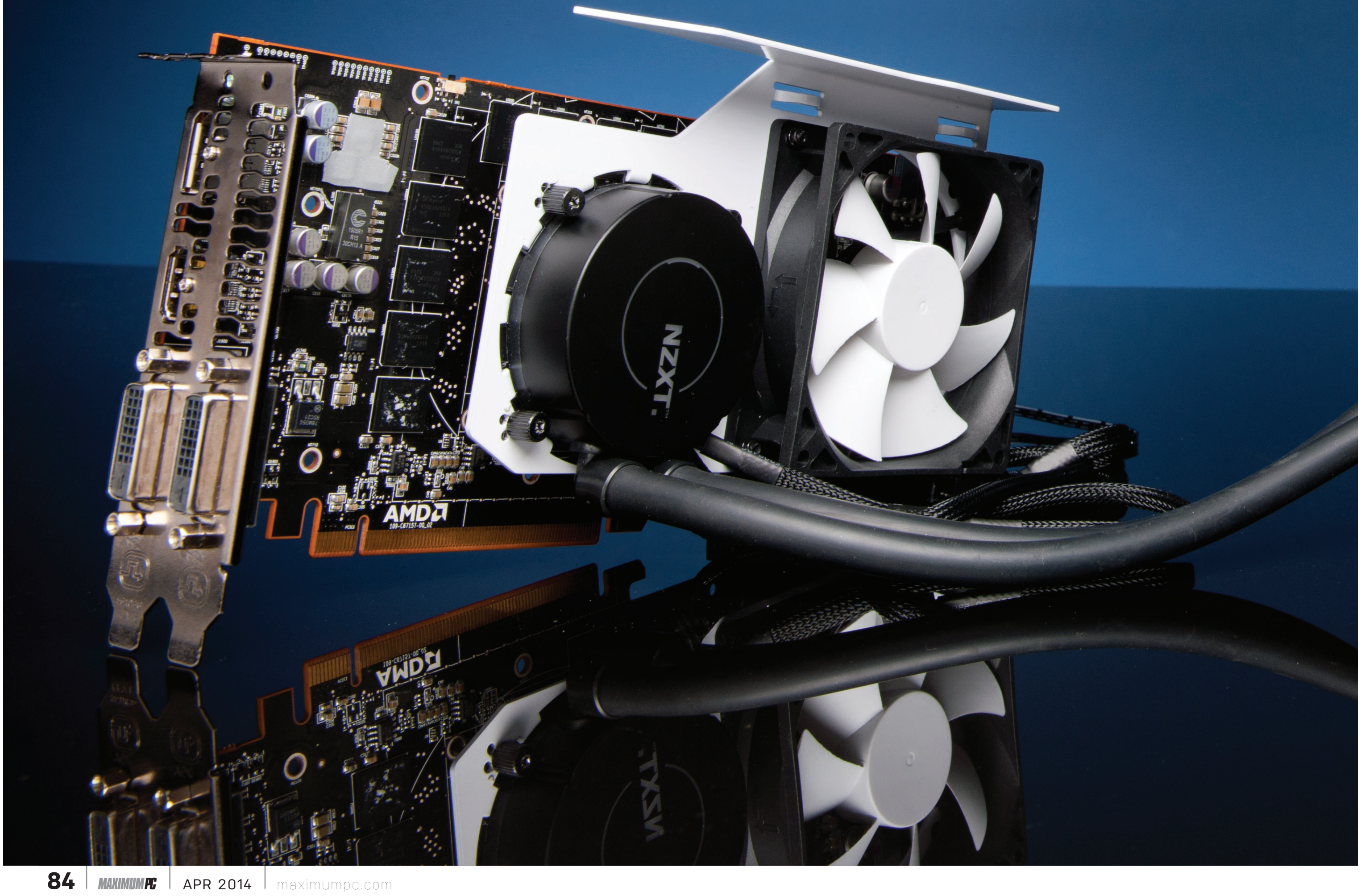
NZXT G10 GPU Bracket

Expensive but colder than a witch's you-know-what

NZXT'S G10 BRACKET is a unique GPU cooler that takes advantage of one incontrovertible fact of today's liquid-cooling market: Most of the coolers out there are designed by Asetek. This snazzy adapter lets you take any Asetek CPU cooler (yes, we said CPU cooler) and bolt it onto your GPU to deliver a level of cooling performance that is simply not possible with an aftermarket air cooler.

The brackets, which are available in black, red, and white, attach to a wide variety of GPUs, including all the AMD and Nvidia cards made in the past several years, with the only exceptions being some Radeon R9 280 and HD 79xx cards. We actually failed to read this little note in the instructions and installed it on a Radeon HD 7970 at first, only to see GPU temps skyrocket to 100 C within five seconds of a load being placed on the card, indicating insufficient contact between the water block and the GPU die. NZXT notes that some GPUs have recessed dies, and will need a shim, which are available online for $4. As the saying goes, “Ain't nobody got time for that!” so we moved onto a Radeon R9 290X for testing. We figured it was the best candidate anyway, since it's notoriously hot and loud. If the G10 could tame that wild beast, it could certainly handle a cooler-running Kepler board, as well. Cooling was provided by a Kraken X40 CPU cooler, also by NZXT, but any Asetek-based CPU cooler would work, including models made by Thermaltake, Corsair, Zalman, and Antec.

Installation was painless. We removed the stock cooler, fitted four long screws through a backplate, poked it through the board, then lowered the G10 bracket (with the water block attached) onto the GPU heat spreader. Four nuts were secured to the screws, and it was in place. Next, we mounted the radiator and fan inside our case, then connected the 140mm fan to a header on the bracket. There's a VRM fan on the G10, and it also attached to a header on the G10. Power for the pump and the fans comes from a lead that connects to a USB header on the mobo.



Overall, the installation was straightforward and easy to follow.

Upon our first boot, we noted that idle temps were around 40 C, which is very low. Once we began to push the card, instead of rising to its normal 94 C, we saw temps slowly rise up to around 53 C and then stay there throughout testing. This let us overclock the card to a scorching 1,120MHz, netting a 10 percent gain in performance. It's also extremely quiet, and with the Kraken Kontrol software we were able to fine-tune the fan curve, or select modes such as Extreme or Quiet.

Overall, the G10 is the best GPU cooler we've ever tested. It's expensive, sure, but performance like this is never cheap. The only fly in the ointment is that aftermarket cards from Asus, EVGA, Gigabyte, et al, cost less, allow similar if not better overclocking, and are almost as quiet. Obviously, if you're running a closed-loop CPU cooler, you'll also want to make sure you can fit two coolers in the case. If you must do water, this is the way to go. Thrifty upgraders will want to just go with a GPU with a non-reference cooler, though. **–JOSH NOREM**

VERDICT
9
KICK ASS!

NZXT G10 GPU Bracket

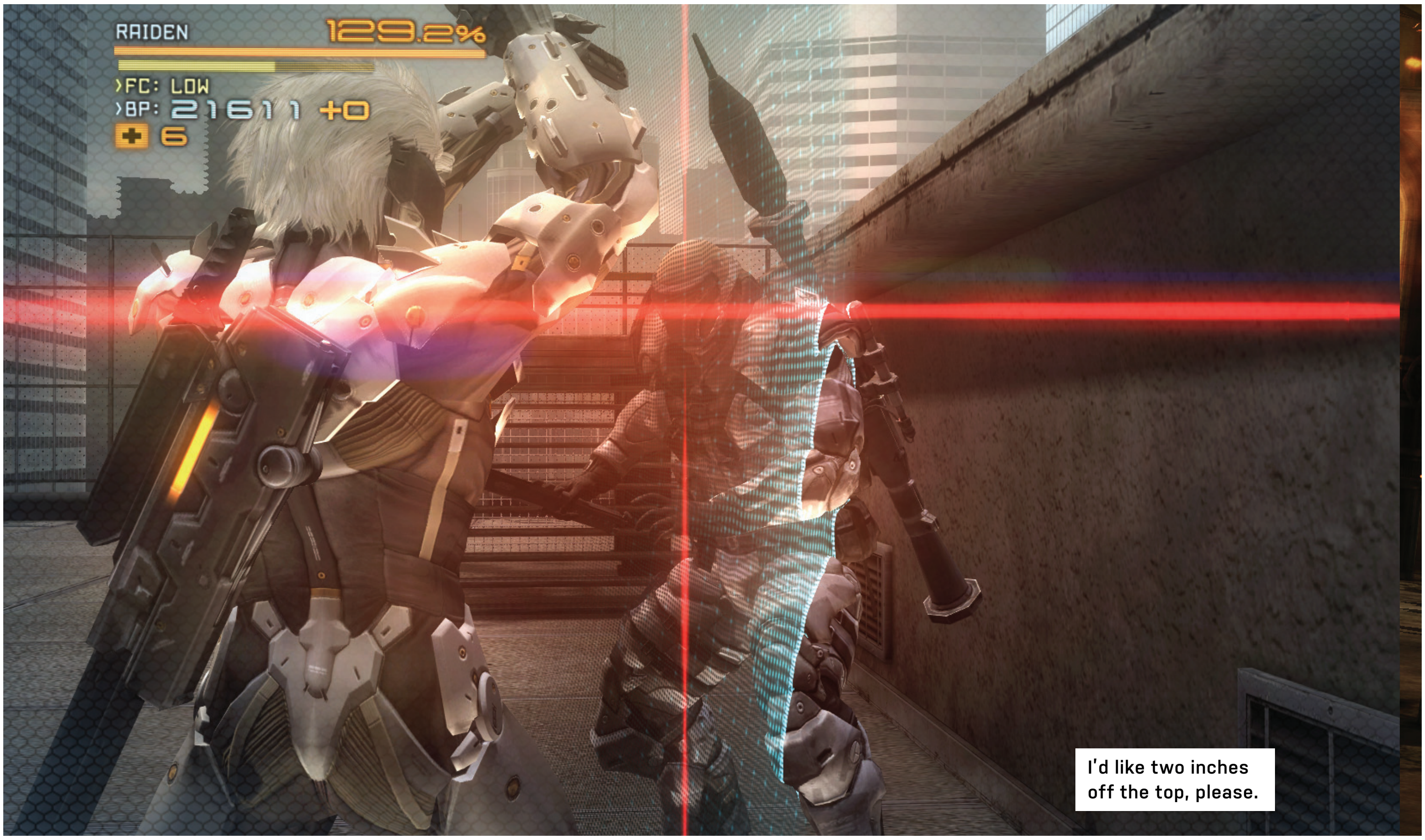
➕ **ALL BALLS** Impressive performance; comes in three colors; easy install.

➖ **JV** Only worth it for reference coolers; expensive compared to aftermarket GPU cooler.

$30, www.nzxt.com

CE RoHS
NZXT
Kraken X40

The G10 is BYOCLC; we used a Kraken X40 in our tests.



I'd like two inches off the top, please.

Metal Gear Rising: Revengeance

Crazy good fun, but also crazy

AS MUCH AS we initially disliked the over-the-top storyline, action, and gameplay of Metal Gear Rising: Revengeance, the more we played, the more we found ourselves growing quite fond of the game. It's more like exercise than a bad wine; worth sticking with for the end results, rather than tossing out after the first sip or two.

We still don't quite get what's going on with the plot, and suspect that other Metal Gear newbies will approach this game with a bit of head scratching. As far as we can gather, your main character is (eventually) a cyborg-human hybrid that fights against other cyborg-human hybrids, plain ol' humans, crazy giant killer robots, and all sorts of other screen-filling insanity.

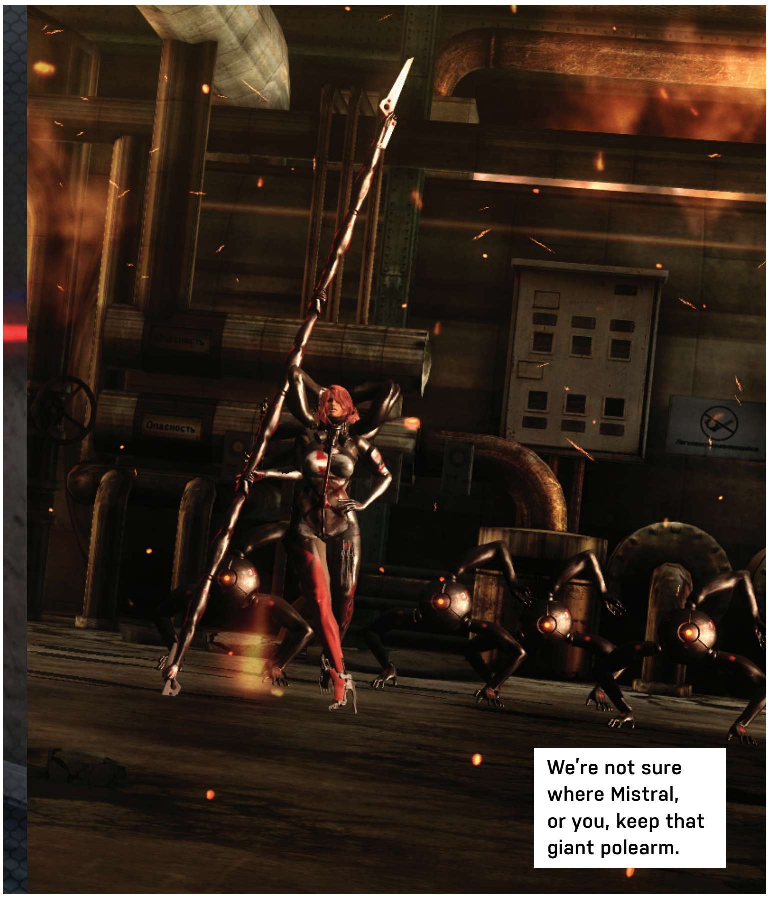
It's you versus the military-industrial complex of the future. And you get a robot dog. And you try to save children's brains. And you can do it all in a mariachi costume, if you're so inclined. We're not making this up; you Metal Gear veterans know the drill.

If you're curious about the "revengeance" bit—a made-up word, we'd like to note—the answer comes fairly quickly into the game's prologue. Your tin-can-to-be, Raiden, is working as a bodyguard/toaster-for-hire. One wrong mission later, punctuated by an energy sword–like object going right into your face, and you're a hacked-off cyborg fighting in the name of peace and happiness.

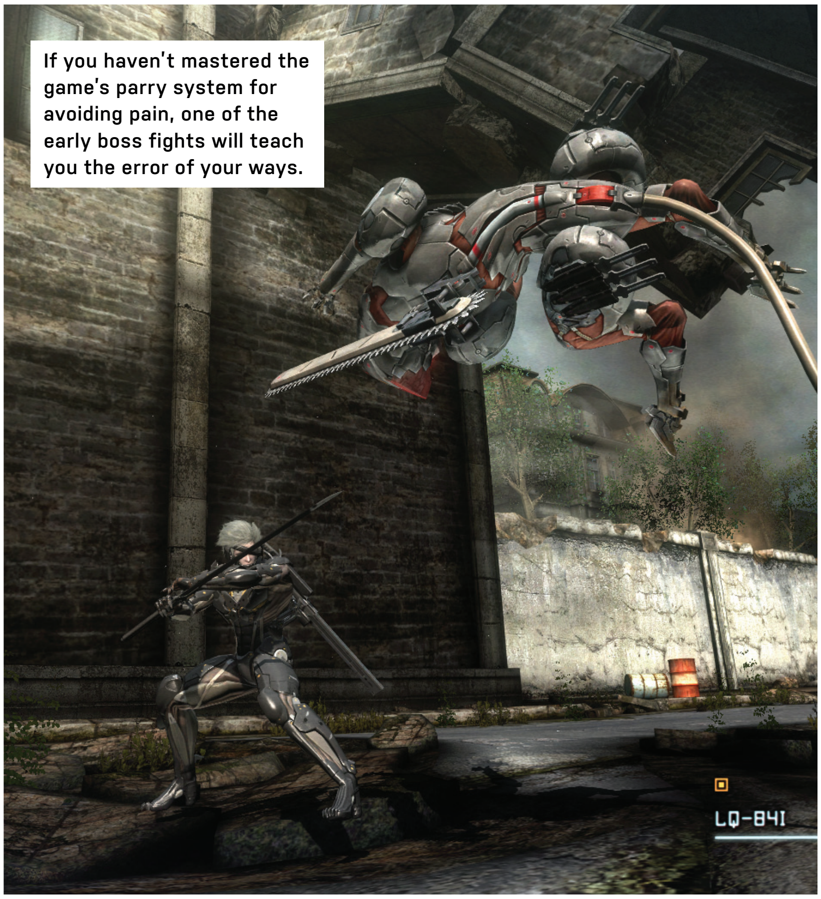
We sound a little tentative about the plot, we realize. It's not our fault; it's a bit of a trip. No matter what, though, you must resist the urge to skip the cutscenes, regardless of how silly they might feel sometimes (or how many there may be). The cinematics are as action-packed as they are beautiful (and gory), interspersed with the primary gameplay just enough to captivate lost gamers throughout the eight-chapter game.

The game-changing element of Revengeance—or at least, the new element that transforms the title from mere hack-'n'-slash into a bit more of an art form—is the inclusion of a new "Blade" mode. Think *The Matrix*, but with a sword that can cut through just about anything (torsos, especially). Be more surgical with your Ginsu demonstration and you can gain upgrades for your character by cutting off the left hands (?!) of your cyborg foes. Get wilder, and you can rip out spines for more health and energy (slow-motion time), lop off legs, food-process your foes, et cetera.

The mechanic, while fun, does require a bit more precision than you might expect. You move your mouse around to set the exact angle for the chopping while simultaneously using the WASD keys to control



We're not sure where Mistral, or you, keep that giant polearm.



If you haven't mastered the game's parry system for avoiding pain, one of the early boss fights will teach you the error of your ways.

Raiden's targeting. Lining up your sword can be a pain in the butt, and it's annoying to turn your target into a split banana when you thought you were perfectly aligned to simply take off an arm. A few hours of this and we were ready to trade in our keyboard and mouse for a controller. Or, better still, a simple Fallout 3–like targeting system.

Also irritating: The game ranks your fighting prowess after each chunk of combat and awards you points for how well/quickly/skillfully you unleashed the pain. You then use these points to buy new abilities, weapons, and stats boosts. We're not fans of the rating system, as the game's fairly frantic pacing makes fight-planning a bit annoying. The upgrade system is fine, but it, like the rest of the game, just expects that you'll "figure things out" along the way. We'd love to have more tutorials for combos, purchased moves, and a better sense of what some of the upgrades actually mean for your character.

On top of that, Revengeance throws in a collectables system—something we didn't realize until we were about three chapters in and stumbled across a weird object that we could pick up off the ground. Whoops. There's also a strange "call your buddies" option, where you can chit-chat with the various members of your organization. We don't really get the point, unless you want a bit more exposition (rather, a lot more exposition) of the game's complicated plot.

Though it does sound a bit like Platinum Games bolts a ton of extras onto Revengeance, these elements are easily forgiven in the heat of the game's frantic, button-mashing, stuff-cutting action. Even though we often felt as if we were eschewing strategy for a combination of running around and left-clicking as fast as we could, we actually did find ourselves warming up a little bit to the game's intended techniques. One learns how to parry quite quickly when suffering defeat after agonizing defeat against the game's harder-hitting baddies (and bosses).

A note on that: The game's boss fights do feel a bit formulaic, in the sense that the frequent mishmash of cutscenes, quick-time events, and general pattern-like fighting diminishes some of the allure once you've figured out the secrets. You could say that for just about any video game, though; we just happened to particularly notice it here.

Revengeance isn't so much strategic—even with the cardboard box sneaking around—as it is *insane*. That's fine with us, especially since you get more upgrade points for killing everything in sight than you do for Assassin's Creed–like trickery. You're going to grumble with frustration when a boss the size of your screen pummels you into the ground for the eighth time in a row; you're going to sigh at some of the exceedingly lame dialogue; and you're going to wince when yet another limb/body/person explodes in a gory mess.

Above all else, though, you're going to have fun. And given how replayable Revengeance is, you're going to have *fun* squared. **–DAVID MURPHY**

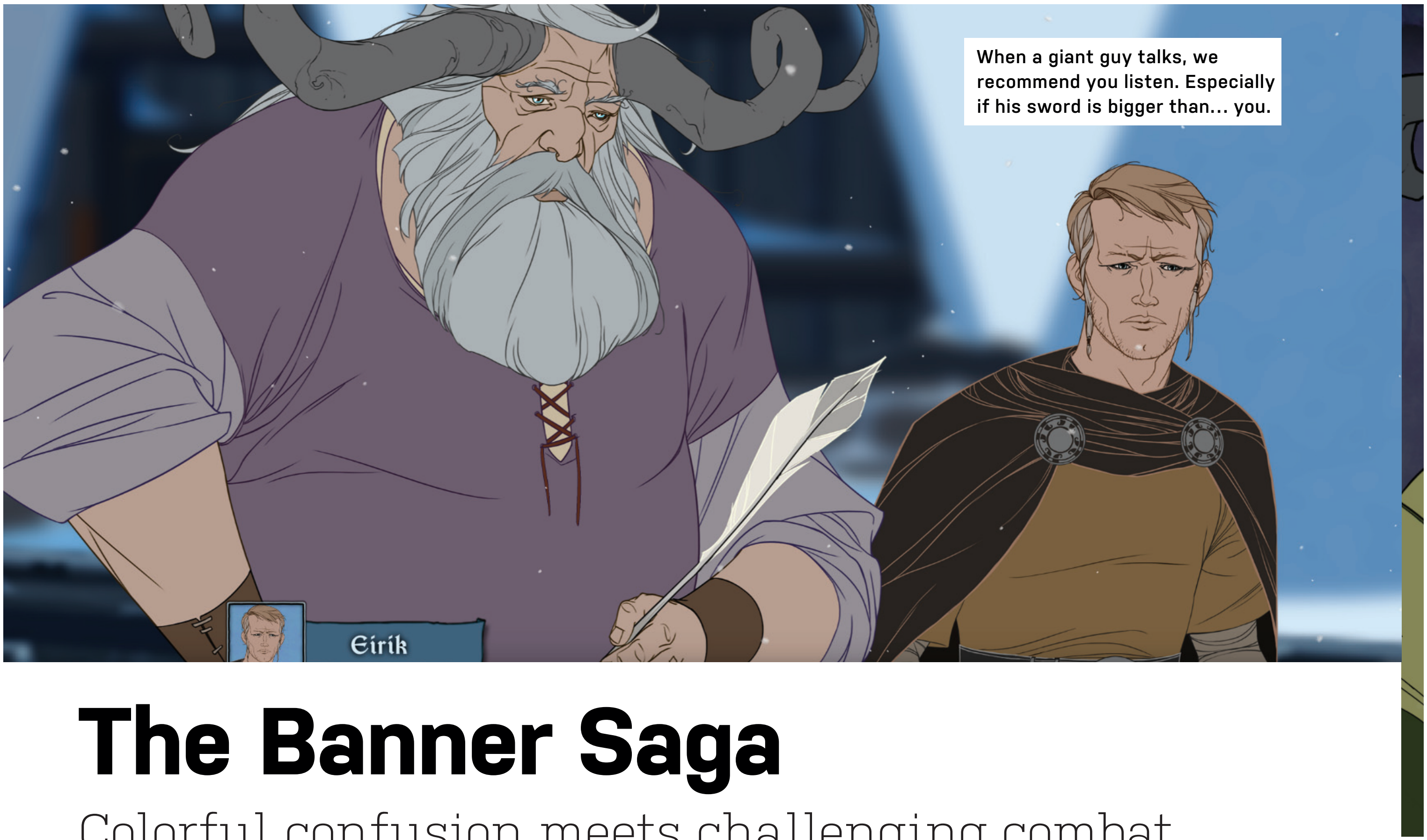
VERDICT
8

Metal Gear Rising: Revengeance

⊞ **REANIMATION** Awesome cutscenes; lovely visuals; quick, vibrant gameplay; plenty of replayability; Blade mode never gets old; absurd boss fights.

⊟ **RECALCITRANCE** Hard-to-follow storyline (especially for newbies); annoying combat scoring system; stealth seems secondary; more tutorials and hand-holding needed.

$30, www.konami.jp/mgr, ESRB: M



When a giant guy talks, we recommend you listen. Especially if his sword is bigger than... you.

The Banner Saga

Colorful confusion meets challenging combat

ASSUMING THAT game publisher King hasn't Candy-Crushed Stoic's The Banner Saga by the time you read this, the Nordic-themed title remains worth checking out, above all, for its gorgeous visuals. Seriously. We almost wish the game were an adventure title instead of a jack-of-all-trades tactical skirmish meets Choose Your Own Adventure book meets Oregon Trail kind of a setup.

We didn't make that up.

At its core, Banner Saga is... something. We're not exactly sure where to place it on our giant map of Viking-themed games, given all the cross-population of genres that takes place within the roughly 10–15-hour title—the first in a three-part series.

While we appreciate Stoic's big mashup for its originality, we can't help but feel as if Banner Saga's three separate identities lack precision. To us, they don't feel as strong as they could have if the developers had just concentrated on one (or two) concepts.

First up: the story. When we say "story," we're referring to the overall tale that involves your band of humans and Varl—Viking-themed horned giants—trying to figure out why the sun has disappeared and how their cultures might best survive an invasion of the armored, robotic-like baddies known as Dredge. We're also referring to Stoic's practice of advancing (and customizing) the plot by giving you plenty of "pick what to do" moments. Choose correctly, and you're rewarded; choose incorrectly, and you might send one of your party members off a cliff to his squishy death (sorry, Gunnulf).

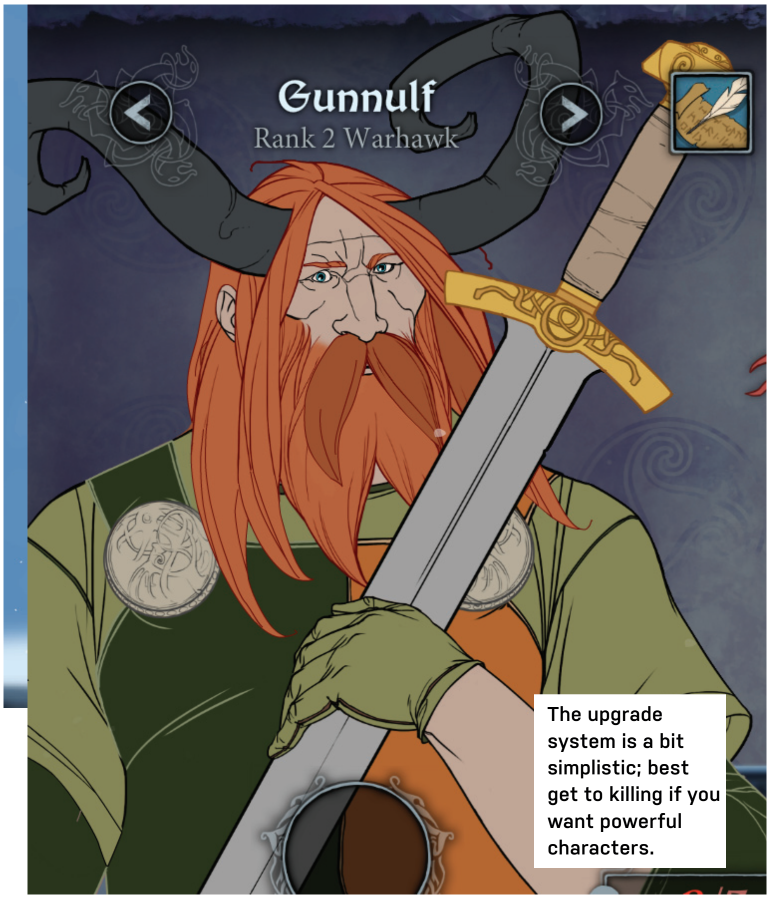
It would be a bit much to say that Banner Saga's narrative is worth a comparison to *Game of Thrones*, the fantasy epic that we've seen associated with most mentions of this game. There might be just as many characters as you'd find in a George R.R. Martin masterwork, but it's hard to keep track of who's who. This is partly a fault of the game's Viking-inspired background: We found ourselves quickly having trouble differentiating one crazy-named warrior from another (Mogun? Hogun? Hakon? Iver? Griss?).

This could have been easily solved if Stoic had voiced all of the characters' dialogue in every possible instance. That, and the game's considerable dialogue would have played better from a storytelling standpoint. It's hard to conjure up much of an emotional attachment to shifting pictures and text speech; it makes the game feel oddly quiet, like flipping through a digital comic book instead of hearing the worry, fear, and rage present throughout the characters' interactions. These are (sort of) Vikings, damn it; they need a little verbal *oomph*. And it doesn't help that Stoic also juxtaposes two separate storylines and characters within Banner Saga's first "act."

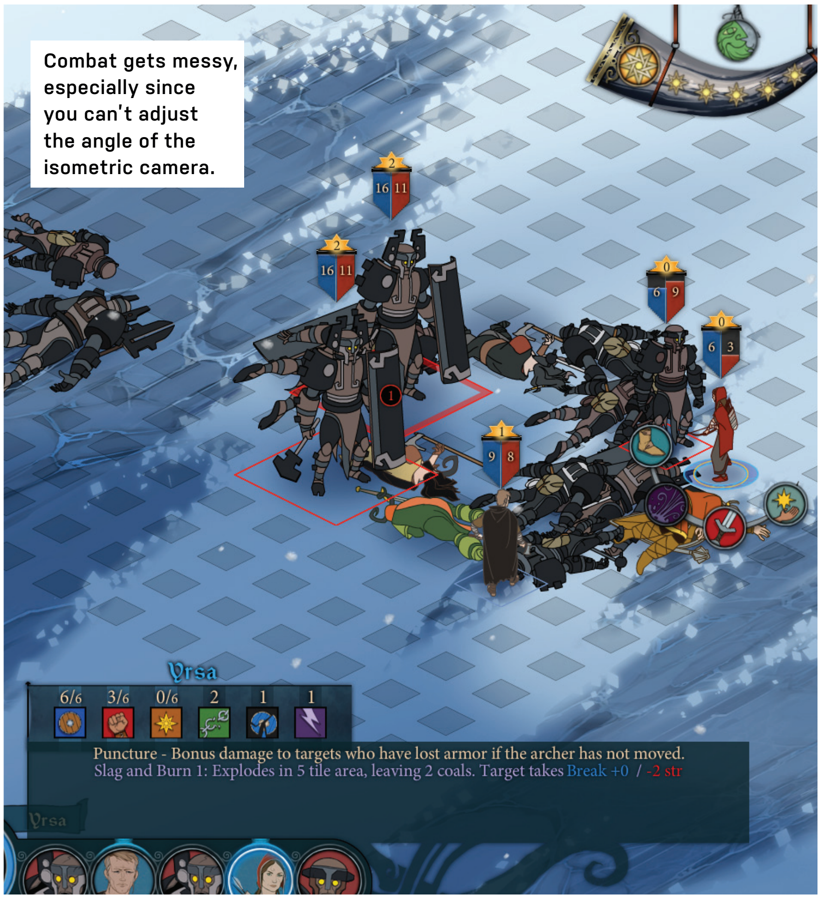
Here's where things get even more confusing: Your primary "upgrade currency," for lack of a better phrase, is Renown. You mainly gain Renown by killing things, but you can also earn it as a reward for choices you make at the game's various decision points. Your Renown isn't universal at first; what you don't spend in the game's first chapter carries over to the third, but that's isolated from the Renown you earn with your second set of characters. If you spend your renown unwisely early on, you might compromise your caravan when the game flips back to these characters in later chapters.

See the problem? It can be difficult to figure out the best time for upgrading your characters. To Banner Saga's credit, though, you can pretty much upgrade your current party whenever you want to. That is, if your characters are Terminators.

Having heavy-hitting, front-line fighters rack up kill after kill is great for Renown generation, but it presents a problem for the game's mechanic: Your characters' *ability* to level up is tied to how many kills they make. Our back-of-line, wussy archers didn't get much upgrade love, but



The upgrade system is a bit simplistic; best get to killing if you want powerful characters.



Puncture - Bonus damage to targets who have lost armor if the archer has not moved.
Slag and Burn 1: Explodes in 5 tile area, leaving 2 coals. Target takes Break +0 / -2 str

Combat gets messy, especially since you can't adjust the angle of the isometric camera.

they did get one-shotted by the Dredge an awful lot. Killing for experience is a great idea on paper, but we prefer a more robust experience system.

Tactical combat is Banner Saga's second major focus. It's a stripped-down version of what you might find in a conventional Heroes of Might and Magic or Disciples game—with a few twists. First off, you don't have an "army" in the traditional "tons of stacked units" sense. You have humans and their super-huge Varl friends; the former are squishy, but dexterous, whereas the latter are giant, lumbering tanks.

Each character gets one official "ability" that you can click to use during fights. It's powered by a "Willpower" stat, a pool of points that decreases every time you use your ability or elect to boost up the damage you perform on any single, gorgeously animated hit. This is a critical mechanic that can tip a fight in your favor, which we quickly learned after getting sent off to Valhalla (or wherever) multiple times by the Dredge. Thankfully, dying in combat isn't permanent; your character merely loses strength (damage capabilities) for a few days' worth of in-game time.

The game has an interesting armor/hit points dynamic. You can target one or the other when hitting a foe—damaging the armor allows you to kick up the hit points damaged. Minus that, combat is fairly cut-and-dried—and quite difficult.

We don't like how Banner Saga treats unit order: Everyone alternates, which means that two fairly heavy-hitting sluggers can put a world of hurt on your larger party of characters if it takes you, say, six turns to control the one that they're ripping apart.

Banner Saga's third game-within-a-game is its strange Oregon Trail–like approach to your caravans' adventures. Since you're basically controlling parties of refugees, you have to spend Renown to purchase food for your camp. Run out of food, and your larger body of warriors starts dying off. It's an odd mechanic for Stoic to throw in out of nowhere; we get the point from a story perspective, but it's just one more unnecessary element that could have just as easily been omitted.

There's also the game's "war" mechanic, whereby you elect to send chunks of your army to their death, in exchange for making individual battles harder or easier. Send more of your nondescript fighters to die, and your heroes can have five-to-one odds against the Dredge in your accompanying fight. Preserve your caravan, and you're in for quite the challenging encounter. It's another neat idea on paper, but one that feels sloppy in its execution—another example of a larger "number-counting" mechanic that the game doesn't really need.

Even with these flaws, Banner Saga is one of the prettiest titles you'll play this year. Its storyline, while confusing, delivers a strong experience when coupled with the game's *Choose Your Own Adventure* mechanic. You'll find plenty to enjoy if you think of this title as more of a graphical novel than tactical demonstration. We commend Stoic for its inventiveness; this Kickstarter-born title just needs more focus and refinement to get its individual pieces to sing in delightful, Nordic harmony.

–DAVID MURPHY

VERDICT
7

The Banner Saga

+ SWEDISH CHEF Gorgeous visuals; lovely soundtrack; gripping decision-making system.

– SWEDISH MEATBALL Text-based storyline needs voices; unnecessary Oregon Trail–like mechanic for survival.

$25, www.stoicstudio.com; ESRB: None

LAB NOTES

JOSH NOREM **SENIOR EDITOR**

Tough Times for Pixel Peepers

If you're like me, finding the right 4K monitor is still tricky

IF YOU READ THE 4K feature I wrote this month (page 22), you'll know The Lab has turned into an all-you-can-eat buffet of pixels from the big 'un 32-inch Sharp/Asus panel to the insanely high-PPI Dell 4K panel.

Take it from me—seeing a game running at 4K for the first time is like seeing a girly magazine for the first time, and you will have the exact same reaction, which is to just stand there staring at it in stunned silence. If you are able to express any words, it'll probably be something like "wow" in doge speak. It's amazing, no doubt, but the problem for me is that right now there is a yawning chasm between the absolutely perfect 27–30-inch LCDs on the market, and the less-than-stellar current crop of 4K panels, which are either so badass they require a down payment and a mortgage, or kind of low-end with TN panels and 30Hz refresh rates. As someone who is a photography prosumer, hardcore gamer, and general purveyor of top-notch gear that doesn't cost a fortune, the situation is unfortunately not acceptable right now.

Why it's unacceptable for me is that my "perfect" monitor is 27–30 inches, has 4K resolution, 60Hz refresh rate, and is an IPS panel, and so far, that does not exist. The closest thing to it is the gorgeous Dell UP2414Q, which at 24 inches has the highest PPI of any desktop display we've seen. But it's a 24-inch LCD, which, for someone who has been using a 27-inch panel for the last few years, is just too small. A two-panel setup would be a likely scenario, except that's not possible on one GPU at this time, since only DisplayPort can pull 60Hz at 4K, and there's only one DP output per GPU.

So, for now, I will continue rocking my 27-inch 60Hz IPS Dell panel, and might be for the foreseeable future. A really tough call would be if someone released a 120Hz IPS panel at 2560—then, I'd really be torn.

Dell's 4K 24-inch LCD is so wow, I just wish it were bigger.

JIMMY THANG

Online Managing Editor

If there's one thing I've learned from reviewing laptops, it's that size matters. I'm not just referring to portability, as size also plays a part in performance. Take this month's AVADirect Clevo laptop (page 78). It has a beefier i7 CPU than our Alienware 14 zero-point, yet it failed to perform as well. The "superior" processor in the Clevo performed below par because it's a small notebook and doesn't have enough room for proper cooling, so the CPU throttles under load. This isn't the first time we've seen this issue, so take note of this when you buy your next notebook—specs can be misleading.

Tom MCNAMRA

Associate Editor

My desktop PC at home is a full-tower, but there's something to be said for a mini-ITX build. It's highly portable and you can stick it anywhere. In a similar vein, I'm digging the Dell UP2414Q 24-inch "4k" Ultra HD monitor, as it also saves quite a bit of desk space, leaving more real estate for tinkering. Those 4K panels cost a pretty penny though, so it's quite a price bump from the 2560 LCDs we've been using, unless you don't mind a TN panel. I've been spoiled by IPS panels though, so it's hard to go back.

First Look: Into the currency mines we go

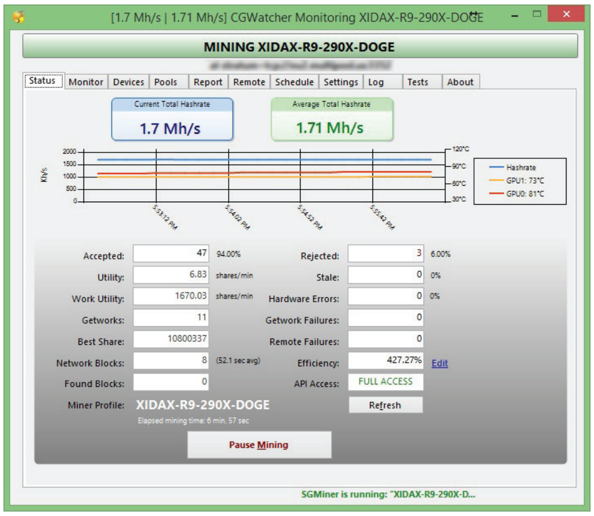
The Xidax M6 Mining Rig poses an interesting question: Can a rig pay for itself in four months?

I ADMIT THAT I'm a skeptical person; perhaps even cynical [*Ed: No, not you, Gordon*!]. A lifetime of being burned has given me a healthy dose of mistrust when I'm offered something that seems too good to be true, because—let's be honest—it always is. That's why reviewing the Xidax M6 Mining Rig (page 70) was so difficult. You see, I've been around PCs for a long time now, and have a pretty good feel for what they're capable of. I know what a quad-SLI box should do in gaming, what a Core i7-4770K overclocked to 4.2GHz can do in an encoding test, and what SSDs in RAID 0 will deliver when it comes to read speeds. With the M6 Mining Rig though, I'll admit I was a little confused. Judged purely on its performance in our benchmark suite, it certainly didn't blow me away when compared to machines with more in the GPU and CPU departments. The promise of the M6 Mining Rig isn't just gaming or productivity, though—it's about having a machine that can game during the day and then make you money at night by crunching crypto-coins.

Now, I'll be the first to admit that my knowledge of mining is pretty rudimentary; it's one of those things I classify under "kids these days," which made the 8 verdict I gave it even more difficult. That's a fair verdict based on its price and performance, but if it really could pay for itself over time, then the verdict should be higher. On the other hand, there were some in the office who thought the verdict should have been *lower*, since the real value of the machine is based on its ability to mine for crypto-currency, and by the time you've mined enough coins to pay for it, the market could have already crapped out or been closed by the government, for all we know.

However, rather than just project my skepticism onto the box, I think the only way to really validate Xidax's claims is to let this sucker mine for a few months. We'll find a nice, isolated spot in our office and just let the M6 do its thing. We'll run it all day and all night, since the Chairman of the Board, Mark Wood, is paying for our power, anyway. We'll keep tabs on the coins it mines and see how much cheddar it can deliver to the *Maximum PC* coffers. Xidax originally said the M6 Mining Rig should generate enough cash to pay for itself in about four months, but given current market rates and the system's $3,000 price tag, that estimate has been shortened to 3.5 months. With the fluctuations in the value of coins though, that could drop to two months or climb to 12 months tomorrow.

As our mining adventure begins, the first thing we need to figure out is what to do with the coins we mine. If we can get it exchanged, what do we do with the cash? We certainly can't keep it, so perhaps we'll donate it to charity or splurge on the biggest lunch order ever from Julie's, our favorite deli in nearby Brisbane. Or maybe our corporate lawyer will step in and cancel all the fun and burn the cash. Either way, we'll report back in a few months to let you know how the experiment is progressing. **–GU**



[1.7 Mh/s | 1.71 Mh/s] CGWatcher Monitoring XIDAX-R9-290X-DOGE

MINING XIDAX-R9-290X-DOGE

[redacted]

Current Total Hashrate: 1.7 Mh/s
Average Total Hashrate: 1.71 Mh/s

Accepted: 47 94.00%
Utility: 6.83 shares/min
Work Utility: 1670.03 shares/min
Getworks: 11
Best Share: 10800337
Network Blocks: 8 (52.1 sec avg)
Found Blocks: 0
Rejected: 3 6.00%
Stale: 0 0%
Hardware Errors: 0 0%
Getwork Failures: 0
Remote Failures: 0
Efficiency: 427.27%
API Access: FULL ACCESS
Miner Profile: XIDAX-R9-290X-DOGE
Elapsed mining time: 6 min, 57 sec

SGMiner is running: "XIDAX-R9-290X-D...

We are putting the M6 to work mining Doge coin to see if it can actually pay for itself.

GEEK TESTED & APPROVED

Nomad ChargeKey

If you're like us, you're a minimalist (and great at parties). You don't lug around a phone charger and USB cable everywhere you go—but secretly, you wish you could. Thanks to the Nomad ChargeKey, you can remain a minimalist and still get your juice on. This tiny device is basically a really short micro-USB cable designed to fit on your keychain. (There is also a Lightning version for Apple devices.) The midsection is made of rubber, is quite flexible, and it's black, so it goes with everything.

We used it around the office, and it performed well with a random Dell monitor's integrated USB 2.0 port, and with a powered USB 3.0 port. It held through twisting and hanging, just as advertised. The price tag of $25 is high, as traditional USB cables are much cheaper, but we think the design is innovative enough to warrant it. $25, www.hellonomad.com **–TM**

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Crashfield 4 Premium
> Traveling with Liquid Cooling
> Safety Dance

Battlefield Bitching

Could you please do a major piece on how big a giant failure DICE/EA and AMD have been with Battlefield 4? So many players have numerous issues. Many of us are using AMD systems and can barely play the game. EA/DICE and AMD support refuse to respond to emails or forums. DICE keeps posting "patch notes" that claim to fix things that aren't fixed. I am a lifetime AMD and Battlefield franchise fan, but I may just jump ship and go Nvidia/Intel and stop buying Battlefield games. I feel so screwed. I pre-ordered Battlefield 4 Deluxe plus the premium edition , spending $120 just to be plagued with countless unplayable hours trying to trouble-shoot problems. The bugs that caused BSOD actually corrupted my Windows 8 installation twice. I had to *rebuild* my entire OS twice because of BF4 and AMD. Both of these companies need to be called out by the media outlets for failing so hard.

—Jesse Snell

BRAVO SQUAD LEADER JOSH NOREM RESPONDS: We hear you Jesse. It's been a rough launch for us, too, though most of the staff uses Intel/Nvidia machines, so we can't comment on your AMD troubles. We've experienced almost all the showstopper bugs though, have been kicked from servers, lost sound, had rubberbanding on Flood Zone, gotten stuck on geometry, gotten one-shot killed by a dude 100 yards away behind a cement wall, and so forth. It's easily one of the worst launches we can remember, and we'll certainly be much more hesitant to pull the trigger on the pre-order screen when Battlefield 5 rolls around, you can bet on that.

The Other Side of the Coin

When Windows 8 previewed, I wasn't impressed. The reviews and opinions frightened me. Windows 7 continued to treat me well with no surprises. The tablet revolution looked like a bunch of non-serious toys until the Surface Pro arrived. But, way too expensive.

I'm writing this on my new HP Omni10 tablet that cost only $400. It has Windows 8.1 and I love it—it just works! And the OS is so easy to learn and use. I'm so pleased. By the way—I'm 64 years old and have been building my own computers since the mid-80s. Will I convert my two Win 7 computers to 8.1? We'll see in a few months.

—David Winokur

The White Zone Is for Loading

I just finished re-reading the Micro-Tower roundup and think I may have found the answer to my gaming woes. I am what I call a transient gamer. I travel for work, spending a month or two in one location before moving on to the next. Most of my gaming has been done on a Gateway P-7811FX, which I bought based on a *Maximum PC* review, but it is long in the tooth with its Core 2 Duo 8400 and GeForce 9800M GTS graphics. I'm tired of not being able to play even last year's games.

A laptop made sense before, because I was traveling a lot more (a week here, a week there, then home for a few months) and it was easy to get through TSA and customs at the airport.

Now, I want something that I can upgrade over time to keep it current and that I can hand-carry onto an airplane. Every place I go has an LCD TV, so I'll use that as a monitor. I think a micro-tower is my answer; specifically, the iBuypower Revolt. My only question is whether TSA would have an issue with the NZXT Kraken X40 because of the water. Would TSA try to open it up? I have emailed NZXT's help desk to find out how much liquid is actually in the X40 but they have not replied. People online have mentioned problems like a burst hose, which could occur if the X40 is put in checked baggage, because of the cold and lack of pressurization in baggage holds.

What are your thoughts on how well or poorly a Revolt would travel on an airplane? (Getting through security checks, checked baggage, etc.) Any help or suggestions would be greatly appreciated.

—Brian Eyestone

DEPUTY EDITOR GORDON MAH UNG RESPONDS: Your idea of a micro-tower is sound. No matter how fast laptops have gotten, they still can't touch desktop graphics nor can they be upgraded easily. As to transporting it, technically, you would not be allowed to bring any liquids on board that aren't in the little plastic baggie. Some argue that TSA is not going to even know what is in the cooler (which is just a few ounces, typically) so you would be OK. But that's not a really a plan, unless you want to get strip-searched by TSA or otherwise tussle with airport security over your PC.

My advice is to get a solid travel case for it, such as a Pelican rolling case, in

↘ submit your questions to: comments@maximumpc.com which you can also store a reduced- size keyboard and your mouse, and check that sucker. Most commercial airlines that take pets pressurize and heat the baggage compartments. The cooler liquid itself isn't water, it's typical mixed with propylene glycol (for corrosion), which has a lower freezing temp than plain-old water. It's unlikely the pressure differences nor temps will hurt the cooler in the luggage compartment, especially inside of a padded Pelican case. Of course, if you're still concerned, you can probably ask iBuypower or your system-builder of choice to swap out the cooler with an air cooler.

I Need a Gaming AIO

As much as I love building and upgrading PCs, I sometimes think an all-in-one gaming rig would be a good option for me. I like the idea of minimizing my PC's footprint, and I don't upgrade my hardware all that often these days.

I know MSI has a couple of AIO models, and a few other companies have AIOs with acceptable specs, but they all seem overpriced. Are there any worthwhile AIO gaming PCs out there? Do any PC vendors build AIOs that I can customize? Maybe my money would be better spent on a gaming laptop.

—Robert Burnham

ONLINE MANAGING EDITOR JIMMY THANG RESPONDS: Unfortunately, the only company making gaming all-in-one PCs at the moment is MSI. Maingear was equipping its Alpha 24 AIO with a discrete GeForce GTX 650 Ti GPU at one point, as well, but they're no longer available. Whether Maingear continues making these machines moving forward remains to be seen. Unfortunately, all of the AIO we've seen only allow you to service the RAM and hard drive, at best. On the flipside: You can build your own AIO, as you may have noticed from our February 2013 issue (see: http://bit.ly/MPC_AiObuild), but we found that to be more trouble than it's worth.

On the bright side, if you're simply looking for something you can game on that won't take up too much desk space, gaming laptops are great alternatives. At the moment, they also offer more pricing flexibility. For instance, you can get a decent gaming laptop from Lenovo for under a grand.

The Safety Dance

I've been pondering a build using a luggable/milspec chassis, but I'm having trouble getting information on the materials. I've heard of chassis with screens up to 23 inches and others with triple 17-inch screens, but I can't locate retailers. I would think the cases would take standard ATX mobos and add-on cards (graphics, etc.).

The reason I'm pondering such a build is because of some of the wreckage I've witnessed by other people's projects at LAN parties. It's amazing how some of the shoebox cases explode when accidentally dropped or knocked over.

—DJ Pearce

ASSOCIATE EDITOR TOM MCNAMARA RESPONDS: Due to the minimum specs needed to qualify as a "rugged portable" or "lunchbox" PC, it appears that they all need to integrate at least the LCD panel and a power supply. Even then, these bare-bones kits are not common. I-Tech Company (www.i-techcompany.com) is the only one that our Google-Fu could turn up, but the company does indeed carry a rugged lunchbox with an integrated 23-inch panel. On the other hand, if you place your PC on the floor and against the wall, that can prevent a lot of accidents. ⏻

[NOW ONLINE]

TOP 7 GOOGLE SUCCESSES AND FAILURES

Google is undeniably one of the most successful tech companies of all time, providing us with awesome services like Google Maps, Gmail, and Android. But along the way, the tech giant had several misfires. For instance, who could forget Google Buzz, Google Wave, and dare we say it, Google+? Join us as we take a look back at the company's seven greatest successes and failures. http://bit.ly/MPC_googleSF

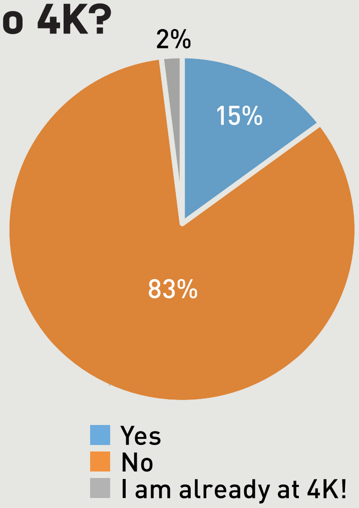
Facebook Polls

How do you define a geek?

In honor of this month's delivery of our annual Geek Quiz, we asked our Facebook fans what they thought is the defining characteristic of a geek. Their answers, as always, were enlightening.

Wesley Crawford: If you have a passion for something, you are a geek for that subject.
Sam Blair: Someone extremely knowledgeable about a subject or subculture.
Charles Tostee Ofei: Being able to keep malware off your PC without security software.
Dominic Olmsted: A geek can get a girlfriend, otherwise they are a nerd.
Richard Garms: When you talk, normal people have no idea what you're saying.
Jason Li: A geek reads *Maximum PC*.
Ryan Hoffman: A geek enjoys/loves what he/she enjoys/loves regardless of social norms.
Gary Diehl: Geeks exercise and nerds do not.
Kyle: Knows the difference between memory and a hard drive.
Michael Flynn: Pretty much the most awesome people you will meet.
Sid Ghosh: Gets turned on by spec bumps.
Rob Whitney: Their desk is a mess, but their desktop is clean and organized.
Zachariah Grooms: Someone who has seen every *Star Trek TNG* episode at least three times.
Dion Miller: Knowing the difference between upload, download, and install.
Chris Moody: See: Gordon Mah Ung—Alpha Geek.

Will you be upgrading to 4K?



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THE BUILDS

PERFORMANCE

INGREDIENTS

PART			PRICE
Case	Corsair Vengeance C70		$100
PSU	Corsair RM750 750W	**NEW**	$100
Mobo	Asus Z87-Pro	**NEW**	$175
CPU	Intel Core i5-4670K		$240
Cooler	Cooler Master Hyper 212 Evo		$30
GPU	EVGA GeForce GTX 760 02G-P4-3765-KR	**NEW**	$250
RAM	2x 4GB G.Skill Ares F3-1600C9D-8GAO	**NEW**	$77
Optical Drive	Samsung SH-224DB/BEBE	**NEW**	$20
SSD	Crucial M500 240GB		$141
HDD	Seagate Barracuda 1TB		$65
OS	Windows 8 64-bit OEM		$100

Approximate Price: $1,298

INGREDIENTS

PART			PRICE
Case	NZXT Phantom 530		$130
PSU	Corsair HX850 850W		$140
Mobo	Asus Sabertooth X79		$320
CPU	Intel Core i7-4820K		$325
Cooler	NZXT Kraken X60	**NEW**	$120
GPU	EVGA GeForce GTX 780 03G-P4-3784-KR	**NEW**	$495
RAM	4x 4GB G.Skill Sniper F3-12800CL9Q-16GBSR	**NEW**	$155
Optical Drive	Asus BW-12B1ST		$60
SSD	Samsung 840 Evo 500GB		$310
HDD	Seagate Barracuda 3TB		$120
OS	Windows 8 64-bit OEM		$100

Approximate Price: $2,275

YOU COULD CALL this "high-performance entry-level." That's where the workhorse Intel Core i5-4670K CPU and the Asus Z87-Pro mother-board come in. This build previously had a Gigabyte Sniper Z87 board, but we favored the Z87-Pro's additional internal USB 3.0 header and integrated Wi-Fi and Bluetooth. You do lose the Sniper's Creative sound and two PCI slots, so your mileage may vary. The Thermaltake Smart-M 750W power supply also shot up in price, but we found a Corsair RM750 to replace it. This premium PSU is overkill for one Nvidia GeForce GTX 760 (arguably the best value for gamers right now), but is ready to add a second card in the future. We slightly adjusted the RAM, video card, and optical drive choices to account for changing prices and availability.

COMPARED TO Intel's Core i5-4670K in the Baseline build, the i7-4820K in this rig is actually slower sometimes, but we wanted an LGA 2011 motherboard. This socket allows up to four video cards without any bottlenecks, while the i5-4670K's LGA 1150 boards can experience bandwidth limitations running just two cards. We've also switched from a Corsair H100i closed-loop liquid cooler to the NZXT Kraken X60 because its larger radiator can cool better and its fans are quieter. The Seasonic M12II 850W is now a Corsair HX850 850W, because the latter performs about the same but was decidedly cheaper as we went to press. We swapped out the 780 Ti for a regular 780 since it packs enough punch and helps keep our budget down a bit. Price changes account for the change in RAM.

ULTRA

YOU MIGHT wonder why we put a 240mm Cooler Master Glacer 240L liquid cooler in this PC, while we're putting a 280mm cooler in the Performance build. Well, the smaller one sports a nearly unique distinction: It's not actually a closed loop. The 240L's tubes are detachable, and the pump has enough pressure to handle more than just a CPU. We've seen it wrangle two video cards, a reservoir, and an additional radiator. The 240L kit also rivals the performance of NXZT's 280mm Kraken X60, despite its smaller size.

Other than that, the Ultra remains largely unchanged from our last build. Its hexa-core Core i7-4930K is a beast, the Asus X79 Deluxe motherboard is high-octane and packed with features, and the GTX 780 Ti is rocket-fueled. The Corsair Obsidian 900D case is cavernous and sturdy, and the high-grade 1250-watt XFX ProSeries power supply should handle three high-end video cards without breaking a sweat. We could shave about $100 off and go with a 960GB Crucial M500 solid-state drive, but we have the budget to justify the Samsung 840 Evo's caching features.

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best.

INGREDIENTS

PART			PRICE
Case	Corsair Obsidian 900D		$330
PSU	XFX ProSeries 1,250W P1-1250-BEFX		$260
Mobo	Asus X79 Deluxe		$349
CPU	Intel Core i7-4930K		$580
Cooler	Cooler Master Glacer 240L	**NEW**	$146
GPU	2x EVGA GeForce GTX 780 Ti		$1450
RAM	4x 4GB G.Skill Sniper F3-12800CL9Q-16GBSR	**NEW**	$155
Optical Drive	Asus BW-12B1ST		$60
SSD	Samsung 840 Evo 1TB		$550
HDD	Seagate 4TB Desktop HDD		$165
OS	Windows 8 64-bit OEM		$100

Approximate Price: $4,145

UPGRADE OF THE MONTH

DELL UP2414Q 24-INCH ULTRA HD MONITOR

If you want an LCD with a resolution higher than 2560x1600 but don't want a huge display on your desk, Dell has a brand-new 24-inch 4K monitor that might be right up your alley. It's the UP2414Q and it sports a crystal-clear 3840x2160 IPS panel, has a fully adjustable stand, four USB 3.0 ports, and an SD card slot. The one we have on loan has amazing pixel density and vibrant colors. **$1149, www.dell.com**

MAXIMUM PC (ISSN 1522-4279) is published 13 times a year, monthly plus Holiday issue following December issue, by Future US, Inc., 4000 Shoreline Court, Suite 400, South San Francisco, CA 94080. Phone: (650) 872-1642. Fax: (650) 872-2207. Website: www.futureus.com. Periodicals postage paid in San Bruno, CA and at additional mailing offices. Newsstand distribution is handled by Time Warner Retail. Basic subscription rates: one year (12 issues) US: $19.95; Canada: US$24.95; Foreign: US$34.95. Canadian and foreign orders must be prepaid. Canadian price includes postage and GST (GST #R128220688). PMA #40612608. Subscriptions do not include newsstand specials. POSTMASTER: Send changes of address to Maximum PC, PO Box 5852, Harlan, IA 51593-1352. Standard Mail enclosure in the following editions: None. Ride-Along enclosure in the following editions: None. Returns: Pitney Bowes, PO Box 25542, London, ON N6C 6B2, Canada. Future US, Inc. also publishes @Gamer, Crochet Today!, Mac|Life, The Official Xbox Magazine, and PC Gamer. Entire contents copyright 2014, Future US, Inc. All rights reserved. Reproduction in whole or in part is prohibited. Future US, Inc. is not affiliated with the companies or products covered in Maximum PC. Reproduction on the Internet of the articles and pictures in this magazine is illegal without the prior written consent of Maximum PC. Products named in the pages of Maximum PC are trademarks of their respective companies. PRODUCED IN THE UNITED STATES OF AMERICA.